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Hough (W. S.). **Present Status of the Rosy Apple Aphid and its Control in Virginia Orchards.**—*Trans. Peninsula hort. Soc.* 1935 pp. 31–34. Dover, Del. [1936.]

In experiments on the control of the rosy apple aphis [*Anuraphis roseus*, Baker] in Virginia by means of dormant and delayed dormant sprays, the best results were obtained by the application of tar distillate (from either coal tar or water-gas tar) in the dormant period [*cf. R.A.E.*, A **22** 600]. Dinitro-ortho-cresol was also good, but more expensive and less easily obtainable. In 1933, a dormant spray of coal tar distillate (2·4 per cent.) gave complete control in an orchard where infestation was 38·3 per cent. Delayed dormant sprays of 1 pt. nicotine sulphate and 5 gals. lime-sulphur per 100 gals. spray reduced the infestation to 0·6 per cent. and were more effective than 3 per cent. oil emulsions, alone and with ½ per cent. cresylic acid of different grades, which reduced it to 2·0–7·2 per cent. In another orchard where the control plot showed an infestation of 81 per cent., 1 pt. nicotine sulphate per 100 gals. spray with 2½ gals. lime-sulphur reduced the infestation to 3·6 per cent., and with 3 per cent. oil to 10·2 per cent.; 3 per cent. oil and ½ per cent. cresylic acid of different grades reduced it to 11·73–18·2 per cent. The application of oil and cresylic acid late in the delayed dormant period tends to scorch the foliage. Satisfactory control has been obtained with oil emulsions used alone or with cresylic acid in light infestations, but not in heavy ones. Young Aphids in the delayed dormant period are more difficult to wet with the spray than the eggs in the dormant period, since they migrate to the sheltered side of the twigs.

Specifications are given of two coal tar distillates (creosote oils) and of two water-gas tar distillates that have proved effective in killing Aphids when used at a concentration of 2½ per cent.

Cory (E. N.). **Codling Moth Situation.**—*Trans. Peninsula hort. Soc.* 1935 pp. 35–36. Dover, Del. [1936.]

Data on the average injury to apples by the codling moth [*Cydia pomonella*, L.] in Maryland during 1935 show that 7·28 per cent. of the fruit was infested and 8·23 per cent. "stung." In the east and west of the State, control was exceptionally effective owing to the low night temperatures, which delayed the hatching of the eggs until a good coverage had been deposited by sprays; but in the centre, infestation of individual orchards reached 25 per cent. The importance is emphasised of the thorough performance of all measures of control while infestation is still low.

Langford (G. S.) & Crosthwait (S. L.). **Experiments on the Control of the Mexican Bean Beetle.**—*Trans. Peninsula hort. Soc.* 1935 pp. 37–39. Dover, Del. [1936.]

An experiment was carried out in Maryland in 1935 to check the effectiveness of magnesium arsenate sprays, which had been recommended since 1930 [*cf. R.A.E.*, A **18** 396; **19** 271], against the Mexican bean beetle [*Epilachna varivestis*, Muls. (*corrupta*, Muls.)] on beans, and to test other insecticides. Each material was applied twice, on 12th and 26th June, and the plants were examined for injury by the beetle on 3rd July. As sprays in 50 U.S. gals. water, 2 lb. magnesium arsenate, 2 lb. of a preparation containing 2·5 per cent. rotenone, 2 lb.

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natural cryolite, and 1¼ lb. barium fluosilicate resulted in 58·5, 25, 19 and 55 per cent., respectively, of the plants being injured by the beetle. In a plot treated with a 60 per cent. pyrethrum dust (0·054 per cent. pyrethrins) at the rate of 16 lb. per acre, 5·6 per cent. of the plants were injured, and plots treated with dusts containing ¾ and ½ per cent. rotenone at the rate of 26½ lb. acre showed 4·8 and 22·1 per cent. injured. Beans planted sufficiently early to be well grown before the beetles emerge from hibernation, or so as to start growth between broods of beetles appeared to escape injury. After picking, the plants should be ploughed to a depth of at least 6 ins., covering all the foliage.

DITMAN (L. P.). **Corn Borers.**—*Trans. Peninsula hort. Soc.* 1935 pp. 61–64. Dover, Del. [1936.]

Brief notes are given on the bionomics and control of five Lepidoptera that bore in maize in Maryland. In addition to *Heliothis armigera*, Hb. (*obsoleta*, F.) and *Pyrausta nubilalis*, Hb., they include *Papaipema nebris*, Gn., which has one generation a year, and may be partly controlled by burning the weeds on which the eggs overwinter. The larvae hatch in spring and feed at first on weeds and grasses, but sometimes migrate when partly grown to maize, tomato or other cultivated plants. They pupate in August, and the moths emerge in September or October. *Diatraea crambidoides*, Grote (*zeacolella*, Dyar) passes the winter in the larval stage in the maize stubble, and has two generations a year, the adults emerging in late May and early June, and again in late July and early August. The maize stubble should be ploughed out, harrowed to remove the soil from the roots, and left exposed to the cold from December till March. From 80 to 100 per cent. of the larvae are killed by this treatment. The larvae of *Laphygma frugiperda*, S. & A., which damage the late crop particularly, are most abundant from the mid-September till mid-October. This Noctuid does not appear to hibernate in Maryland, infestation being probably due to the moths migrating from the south during the summer. Lead arsenate dust gives good control if applied before the larvae have entered the plants.

GUY (H. G.). **Control of the Lesser Peach Borer.**—*Trans. Peninsula hort. Soc.* 1935 pp. 86–88, 2 refs. Dover, Del. [1936.]

The larvae of *Aegeria pictipes*, G. & R., damage and sometimes kill peach trees in Delaware by mining in the cambium of the trunk and lower branches. They hibernate in all instars from the second to the sixth and pupate in April and early May. The adults emerge in 3–4 weeks and deposit eggs singly in crevices on the trunk. These hatch in about a week, and a second brood of adults, which produces the overwintering generation, matures in August. Cultural practices designed to avoid mechanical injuries to the trees decrease infestation.

On 16th April 1935, treatments with 10 oils or solutions were each applied to 10 trees from a group of 110 that were infested heavily but so far as possible equally ; the remaining 10 trees were untreated. All the trees were 10 years old. Each material was applied with a paint brush so as to saturate localised infested areas and a margin of bark round them without girdling the trunks or branches. No gum or rough bark was removed before treatment. The temperature was 36–38°F. The trees were examined about the middle of May. The estimate of percentage control was made by comparing the numbers of living borers

in the treated and untreated trees, since these were more easily found than the dead ones, but if it had been based on the number of borers found dead, the relative efficiency of the treatments would have been substantially the same. The best results were obtained with paradichlorobenzene or lauryl rhodanate, dissolved at the rate of 2 lb. and 1 lb. respectively in 1 U.S. gal. oil. Paradichlorobenzene in crude cottonseed oil, mineral oil or scalecide gave 90, 75 and 73 per cent. control respectively. In the second case the paradichlorobenzene was partly out of solution owing to the cold. Lauryl rhodanate gave 72 per cent. control in crude cottonseed oil, and 68 per cent. in mineral oil. Materials without paradichlorobenzene were affected by the presence of gum and frass.

RICE (P. L.). **Notes on the Ragweed Borer (*Epiblema strenuana* Walk.) and its Parasites.**—*Trans. Peninsula hort. Soc.* 1935 pp. 89–94, 4 refs. Dover, Del. [1936.]

Observations on parasites of *Epiblema strenuana*, Wlk., infesting ragweed [*Ambrosia*] in Delaware [*R.A.E.*, A **23** 695] were continued in 1935. Moisture in the form of free water is apparently essential for the normal emergence of both the adults and the parasites of the overwintered brood. Thus, when overwintered larvae in pieces of ragweed were subjected to different conditions, the numbers of moths and parasites obtained were 1 and 4 from 230 larvae kept dry, 1 and 9 from 250 exposed to high atmospheric humidity under cover from 28th April to 17th May, and 75 and 29 from 122 kept from 29th April to 22nd May in outdoor cages where they were wet by rain. In another test with samples of ragweed collected in April, about 10 times as many moths and 6–8 times as many parasites emerged between 19th July and the end of the emergence period when the ragweed was soaked in water for a few minutes on 17th and 25th July. Emergence of *Glypta rufiscutellaris*, Cress., however, appeared to be unaffected by bringing the host material into the insectary in early April, probably because the parasite is then nearly mature.

G. rufiscutellaris was the most abundant parasite reared from the overwintered brood, followed by *Ephialtes* (*Calliephialtes*) *notandus*, Cress., which attacks a wide variety of hosts but has not previously been recorded from *E. strenuana*. In one area the rate of parasitism by *E. notandus* was so high that in June few ragweed borers in any stage could be found. *G. rufiscutellaris* was also the most important parasite of the first brood larvae, followed by *Macrocentrus delicatus*, Cress. There were only 2 individuals of *E. notandus* among the 503 parasites reared. Other larval parasites not previously recorded from this host in Delaware include *Eurytoma atripes*, Gah., and the Braconids, *Microdus* (*Bassus*) *erythrogaster*, Vier., and *Heterospilus languriae*, Ashm., from the overwintered brood, and *Perilampus fulvicornis*, Ashm., and *Eurytoma tylodermatis*, Ashm., from the first brood. No adults of *G. rufiscutellaris* were taken in the field from 14th May until 1st July, when females were found ovipositing on the first brood larvae of *Epiblema*, and no other hosts were found. Tests also showed that overwintered brood adults of *G. rufiscutellaris* did not attack overwintered brood larvae of *Cydia* (*Grapholitha*) *molesta*, Busck, the codling moth [*C. pomonella*, L.] or *E. strenuana* in the insectary. When kept in cages with a high humidity, the average life of the male *Glypta* was 30·69 days and of the female 49·43 days. On 28th June, 14 per cent.

of the parasites were still alive, and parasitised 5 out of 7 of the first larvae of the first brood of *Epiblema*. In the insectary, the females died within a week of oviposition. If the parasite used no other host in the period between its emergence in spring and the appearance of the first brood borers, then the earliest hatched larvae should be the most heavily parasitised, but experiments in rearing parasites from larvae of different sizes when collected from the field indicate that this is not so.

STEARNS (L. A.), RICE (P. L.) & GUY (H. G.). **Results of Experimental Spraying, during 1935, for Control of Codling Moth.**—*Trans. Peninsula hort Soc.* 1935 pp. 95–102, 1 graph. Dover, Del. [1936.]

Probably owing to the cool, wet weather during the spring and summer, infestation of apples by the codling moth [*Cydia pomonella*, L.] was less in Delaware in 1935 than in 1934 [*cf. R.A.E.*, A **23** 599]. Control measures were consequently more effective.

In comparative tests on Jonathan apples, lead arsenate was the most effective spray, and then calcium and zinc arsenate in that order. Variations in the procedure of application of lead arsenate, such as the position of the operators of the spraying machine, light or heavy spraying, and pruned or unpruned trees, did not affect the control significantly. In testing the effectiveness of different spray programmes, fish oil or summer oil (Orthol-K) proved about equally effective in maintaining coverage of lead arsenate. A petal-fall and 5 cover sprays containing lead arsenate (1 against the second brood) gave 63–65 per cent. of uninfested fruit, while with 2 or 3 cover sprays against the second brood 81–82 per cent. of the fruit was uninfested. For the second brood sprays 2 applications of nicotine and oil or of lead arsenate were almost as effective as 3 applications of the former.

WEIDNER (H.). **Wie kann man Hausbockbefall und von anderen Holzinsekten herrührende Beschädigungen des Bauholzes unterscheiden ?** [How is it possible to distinguish Infestation by *Hylotrupes bajulus* from that by other Wood Insects in constructional Timber ?]—*NachrBl. dtsch. PflSchDienst* **16** no. 5 pp. 48–50, 2 figs. Berlin, May 1936.

In view of the regulations in Hamburg against *Hylotrupes bajulus*, L., infesting timber in buildings, a table is given describing the types of injury done by Longicorns, Anobiids and wood-wasps (Siricids), with a key to the larvae of *H. bajulus* and related species found in inspections in Hamburg.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. dtsch. PflSchDienst Beil.* **8** no. 3 pp. 71–94. Berlin, 1st May 1936.

This issue includes German regulations restricting the use of hydrogen phosphide in pest control. It may be employed as a stomach poison and, by duly authorised persons and subject to special safeguards, as a fumigant also. It has proved a very effective fumigant against the grain weevil [*Calandra granaria*, L.]. Other regulations govern the use of the T-gas (9 parts carbon dioxide and 1 part ethylene oxide) sold as " Cartox " for the fumigation of grain warehouses, especially against the weevil.

[Nefedov (N. I.).] **Нефедов (Н. И.). Contribution to the Ecology of Acrididae of some Districts adjacent to the Urals. The Acrididae of the Troitsk Forest-Steppe Reserve.** [*In Russian.*]—*Bull. Inst. Rech. biol. Perm* **10** no. 4–5 pp. 151–178, 3 graphs, 9 refs. Perm, 1936. (With a Summary in English.)

Numerous collections of Acridids were made by sweeping with a net, in different stations in the Troitzk forest-steppe reserves, in order to elucidate the factors determining their distribution. Particulars are given of the stations inhabited by a number of abundant species. Of these, the hoppers of *Chorthippus albomarginatus*, DeG., occur mainly on alkaline meadows and stations dominated by *Carex*, whence the adults migrate to other habitats, whereas *Arcyptera microptera*, F. W., breeds mainly on alkaline soils with a discontinuous plant cover and its adults, though widespread, avoid meadow grasslands and stands of *Carex*.

The average temperatures at a given time of the day do not differ greatly in various habitats, but within any one habitat there is a considerable difference between the morning, noon and evening temperatures. On the other hand, there is a considerable fluctuation in the abundance of Acridids in different stations, and it is concluded that their distribution and migrations must be determined by sharp temperature fluctuations and by the composition of the plant cover.

Najjar (Halim). **Controlling the Grape Rot and Berry Moth.** [*In Arabic.*]—*Circ. Inst. rur. Life Nr East Fdn Amer. Univ. Beirut* no. 6, 10 pp., 3 figs. Beirut, Syria, April 1936. (With a Summary in English.)

In the Lebanon district of Syria, *Polychrosis botrana*, Schiff., often causes a loss of over a third of the vine crop. It has three generations a year, the adults appearing in late May, at the end of June and in August. The first-generation larvae feed on the grape flowers, but the most severe damage is caused in late summer, when attack on the ripe grapes causes them to rot. Spraying is timed according to the appearance of the moths. A spray of Bordeaux mixture and lead arsenate is applied about the last week in May and can also be given in July, though a non-poisonous mixture of summer oil emulsion (1 per cent.) and nicotine sulphate (1 : 800) is better. This mixture or a dust of barium fluosilicate and lime can be used in August.

Klein (H. Z.). **On the Biology of the Red Scale (*Chrysomphalus aurantii* Mask.) in the Jordan Valley.**—*Hadar* **8** nos. 3–4 pp. 71–73, 115–116, 2 graphs. Jaffa, March–April 1935. [Recd. June 1936.]

Investigations were made in Palestine in 1933–34 on the biology of *Aonidiella* (*Chrysomphalus*) *aurantii*, Mask., which causes severe damage annually to *Citrus* [*cf. R.A.E.*, A **22** 553], in order to study its development under different climatic conditions. In the Jordan valley, there are usually 5 generations a year, larvae being present in January, March–April, June, August, and October–November. They are more abundant in the first, fourth and fifth generations. The scale is viviparous. The period between morphological maturity of the female and the appearance of the first offspring varied in the

different generations from 45–50 days at 13°C. [55·4°F.] and 70–75 per cent. relative humidity to 20–30 days at 27°C. [80·6°F.] and 60 per cent. humidity. The number of eggs in a female averaged 17 on the leaves and 46 on the fruit of grapefruit, and 14·2 on the leaves and 38·4 on the fruit of lemon. The average number of larvae per female that settled was 39 on the leaves and 78 on the fruit of lemon. The length of the developmental period of the larvae and females varied with the temperature and humidity and is shown in tables for the different generations. The larvae developed most quickly (19–21 days) at 26°C. [78·8°F.] and 60 per cent. humidity. The period from one generation to the next was 50 days at 28°C. [82·4°F.] and 60 per cent. humidity and 90 days at 15–16°C. [59–60·8°F.] and 64–67 per cent. The females live 3½–6 months but usually die immediately after the end of their reproductive activity, which occupies about 20–88 days. There is considerable overlapping of the generations. The ratio of females to males was 3 : 1. In experiments with potted trees, the largest number of scales was found in November at harvest time, and the highest percentage of larvae in October–November when favourable conditions for reproduction (23°C. [73·4°F.] and 63 per cent. relative humidity) and for the establishment of the larvae (20°C. [68°F.] and 59 per cent. humidity) obtained. In November the scales were found on all parts of the plant, but were more abundant on the fruit. The largest relative increase in numbers took place in the August generation, which preceded the one most harmful to the crop in October–November. Heaviest mortality of scales occurred in January and February, because of the low temperatures, and in May–June when the hot winds destroyed 50 per cent. Development is much more rapid on mature trees in a closely planted grove than on young trees, as the leaves are protected and natural mortality of the scales is reduced. From October to May the scales are also found on the outer branches of the tree in the Jordan Valley, but in June–October they are only present on the inside branches [*cf.* **22** 554]. The monthly fluctuations in numbers of the different generations in young groves are tabulated.

Although the scale was introduced into Jericho on infested plants some years ago, it had disappeared 3–4 months later and has not been observed since, probably because of the high temperature and exceedingly low humidity prevailing there. The average monthly temperature and humidity in the Jordan Valley, Jericho and on the coast are compared in tables to show their effect on the development and establishment of the scale.

BODENHEIMER (F. S.). **The Florida Wax-scale** (*Ceroplastes floridensis*, **Comst.) in Palestine.**—*Hadar* **8** no. 7 pp. 187–191, 195, 11 figs. Jaffa, July 1935. [Recd. June 1936.]

An account is given of the bionomics of *Ceroplastes floridensis*, Comst., on *Citrus* in Palestine, with brief descriptions of all stages. Males are only known in Japan. The ratio of living larvae to living adults in the coastal plains indicates that two or three generations occur annually. Many larvae of the third (winter) generation were destroyed by climatic factors. From a review of the monthly temperatures in Tokio, Antibes, Tel Aviv and Jacksonville (Florida), where each year there are 1, 1, 3 and 3 broods respectively, the author shows that active development only takes place when the temperature in

the shade is above 20°C. [68°F.]. The annual effective temperature sums [*cf. R.A.E.*, **13** 389; **23** 296] above 20° C. at these places are 324, 393, 669 and 885 day-degrees C. The differences between the life-histories of the scale in these countries and what would be expected from the temperature sums are probably due to the fact that the insects tend to occur on the upper surface of the leaves and their body temperature rises owing to solar radiation. Thus such factors as latitude, atmospheric humidity and altitude have to be taken into account. The dependence of development on solar radiation was shown by the fact that at room temperature in a laboratory that was bright, but shaded from direct sunlight, no individual lived longer than 8 months, and none oviposited. During 1934, when an outbreak of this scale occurred, the number of eggs per female varied from 45 to 1,278, with an average of 415, and the hatching period, which was assumed to be equal to the oviposition period, was 1–2 weeks or less. For the three years 1930, 1932 and 1933 the average number of eggs per female was 233. The optimum temperatures for fertility and the development of eggs and larvae appeared to be about 23–25°C. [73·4–77°F.] or more. In two observations made during May, 443 and 307 eggs hatched in 10 days, at the rate of 6–78 per day. Parasites are found in June, but increase rapidly in July and August. A list is given of 22 species or genera of plants, belonging to 17 families, on which this scale feeds.

CHEN (Fong-ge). **Life History of *Rodolia rufopilosa* Muls.** [*In Chinese.*] —*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 59–77, 19 figs., 14 refs. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

In south-eastern Chekiang, *Rodolia rufopilosa*, Muls., which destroys the eggs and larvae of *Icerya purchasi*, Mask., on *Citrus* [*cf. R.A.E.*, A **22** 550], has 4 generations a year, the adults usually emerging in late June, late July, late August and October. Those of the last generation hibernate and oviposit in April. The egg, larval and pupal stages occupied 2–15, 14–34 and 6–26 days and are affected by temperature. The adult females lived 47–211 days and the males 24–182. Pairing usually occurs between 9 and 12 a.m. The female lays about 400 eggs on or near the egg sacs of *Icerya purchasi*. The pre-oviposition and oviposition periods lasted 6–16 and 5–99 days respectively. The adults destroyed an average of 1·28 larvae and 2·06 eggs of *Icerya* per hour and the third and fourth instar larvae 1·00 and 5·58 larvae per hour. When the Coccid is scarce or not available, cannabalism is very prevalent. *Rodolia* is a promising natural enemy for the control of *Icerya*, as it is well established and has twice as many generations as the latter, but it requires a higher temperature for normal activity.

WONG (Chi-yu) & CHIN (Meng-hsiao). **Notes on two Species of vegetable Chrysomelids in Hangchow (*Phaedon brassicae* Baly and *Colaphellus bowringi* Baly) and their Control Measures.** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 141–151, 9 figs., 4 refs. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

The Chrysomelids, *Phaedon brassicae*, Baly, and *Colaphellus bowringi*, Baly, are the most common and destructive pests of cruciferous

vegetables in Hangchow, where they destroy up to 85 per cent. of the crops annually. There are 3 generations a year in the field, but about 5 were produced in the laboratory. The distinguishing characters of each species are described. The eggs are laid either on the leaves of the food-plants or on the ground nearby. Spraying the plants with an extract of the root of *Tripterygium wilfordi* (*cf. R.A.E.*, A **23** 204] kills the larvae and adults.

WONG (Chi-yu) & KIANG (Sih-chun). **The Relation of Farm Practice and Rice Insects Control in Chekiang.** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 180–188, 2 figs. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

In the centre and west of Chekiang three crops of rice are obtained in a year, whereas in the south, north and east only two are grown, the autumn crop being omitted. Where two crops are grown, they are harvested later and the fields are left fallow longer, so that the insect pests of rice have a better chance to complete their life-cycle and hibernate. Damage is, therefore, always more severe in these areas.

PENG (Peng). **Biology of *Icerya purchasi* Mask. in Hwangyen (Homoptera, Coccidae).** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 189–203, 16 figs., 11 refs. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

The results are recorded of a 3 years' study on the bionomics and control of *Icerya purchasi*, Mask., on *Citrus* in Hwangyen. It has two generations a year, the eggs being laid in mid-May and early August and the adults appearing in July and December. Each female lays as many as 200–805 eggs. The egg and larval stages occupy about 9–27 days and 7–15 weeks respectively, and the adults live for about 9–10 weeks. In the first and second instars the larvae feed on the lower surfaces of the leaves. In the third the females attach themselves to the trunk and branches on which they feed, but the males move about until they are ready to pupate. The leaves of infested trees turn pale brown, and the upper surfaces become heavily covered with a sooty mould. The loss caused by this scale is very great, and in 1933 over 60 per cent. of the area under *Citrus* was damaged. Control measures consist in collecting the scales by hand, fumigating the trees or spraying them with resin wash, and the utilisation of natural enemies, especially *Rodolia rufipilosa*, Muls., and *Rodolia* sp. (*cf. R.A.E.*, A **22** 550].

WONG (Chi-yu). **A historical Record of some important Insect Pests and Plant Diseases in Chekiang within 1912–34.** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 204–225. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

This paper, which is a continuation of a previous one [*R.A.E.*, A **22** 127], records the distribution, incidence, season of occurrence, etc., of pests and diseases, including over 120 insects, attacking various crops and forest trees in Chekiang between 1912 and 1934.

Chen (Fong-ge), Loh (Nie-tsin) & Wang (Fei-peng). **Life Histories of *Cacoecia asiatica* Wals. and *Adoxophyes fasciata* Wals. (Lep. Tortricidae) in Hwangyen.** [*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 226–240, 9 figs., 3 refs. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

Tortrix (*Cacoecia*) *asiatica*, Wlsm., and *Adoxophyes fasciata*, Wlsm., are common on *Citrus* in Hwangyen, the latter being the more abundant and destructive. The larvae of both species are leaf-rollers and pupate in the rolled leaves. *T. asiatica* has 4 generations a year and overwinters as a larva. The adults emerge in mid-May, early July, early August and mid-September. The egg, larval and pupal stages average 7·5, 25·5 and 8·5 days respectively. *A. fasciata* has 6 generations a year and hibernates in the pupal stage. The adults appear in late April, late May, early July, late July, early September and early October. The egg, larval and pupal stages average 7, 36 and 7·5 days respectively. The females of *Tortrix* lay 30–300 eggs and those of *Adoxophyes* 60–260, generally on the lower surface of the leaves. Control measures recommended are destruction of infested leaves and trapping the adults with sweetened baits or in light-traps.

Li (Feng-swen) & Ma (Tsing-chao). **A List of Cotton Insects of the World.**—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 245–271. Hangchow, October 1935. [Recd. May 1936.]

A systematic list is given of 768 species of insects and mites that infest cotton, showing the countries in which they occur and the parts of the plant they attack.

Peng (Peng). **Life History of *Papilio polytes* Linn. in Hwangyen.**—[*In Chinese.*]—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 285–294, 11 figs., 5 refs. Hangchow, October 1935. (With a Summary in English.) [Recd. May 1936.]

Papilio polytes, L., has 4 generations a year in Hwangyen, the adults appearing in mid-May, mid-June, late July and late August. The eggs are laid singly on the tips of the leaves of *Citrus* and other rutaceous plants, on which the larvae feed. The pupae are attached by a thread to the small branches. In the different generations the egg, larval and pupal stages average 3·1–6·1, 12·6–18·8 and 9·5–14·1 days respectively. The winter is passed in the pupal stage.

Uchida (T.) **On two Pyralids sold as Food for singing Birds.** [*In Japanese.*]—*Zool. Mag.* **48** no. 4 pp. 220–221. Tokyo, April 1936.

The hibernating larvae of *Sylepta balteata*, F., and *Pyrausta latipennis*, Warren, are sold as food for birds in Sapporo, Hokkaido. Both these moths have two generations a year, *Sylepta* feeding on oaks and *Pyrausta* on *Polygonum*. *Sylepta*, however, does not occur in Hokkaido, and the larvae are imported from Honshu or Kyushu. They are parasitised by *Pimpla* (*Epiurus*) *persimilis*, Ashm.

Murayama (J.). **On the Distribution of Scolytid Beetles by Human Agency.** [*In Japanese.*]—*Kontyû* **10** no. 3 pp. 113–120. Tokyo, May 1936.

The author records the finding of living examples of the following Scolytids in timber imported into Korea : *Myelophilus piniperda*, L., in *Pinus densiflora* from Tsushima Island ; *Ips laricis*, F., in pine from eastern Siberia ; *Hylastes* (*Hylurgops*) *glabratus*, Zett., in *Picea jezoensis* from northern Manchuria ; and *Ips japonicus*, Niij., in spruce from Sakhalin.

In an experiment, wood of *Carpinus laxiflora* was jarred several hundred times against the ground, but larvae and pupae of *Scolytus claviger*, Bldfd., in it were unaffected, which shows that Scolytids are unlikely to be injured during the transport of timber.

Doke (N.). **On the Effect of Temperature and Moisture on the Biology of *Chilo simplex*, Butl. I.** [*In Japanese.*]—*Oyo-Dobutsugaku Zasshi* **8** no. 2 pp. 87–93. Tokyo, May 1936.

In experiments, adults of *Chilo simplex*, Btlr., emerged from the pupae at temperatures of 15–38°C. [59–100·4°F.] and relative humidities of 10–100 per cent., the optima being 25–26°C. [77–78·8°F.] and 100 per cent. humidity. The optimum temperature for pupal development was 34°C. [93·2°F.]. The pupae were not affected by variations in humidity. The eggs hatched at 13–36°C. [55·4–96·8°F.] with 70–100 per cent. humidity. Embryonic development occurred at the same ranges, the optimum being 22–26°F. [71·6–78·8°F.] with 90–100 per cent.

Okada (I.). *Fungivora fungorum*, **DeGeer, an unrecorded Species from Japan, and its Food-plants.** [*In Japanese.*]—*Oyo-Dobutsugaku Zasshi* **8** no. 2 pp. 94–98, 1 fig. Tokyo, May 1936.

The Mycetophilid fly, *Fungivora fungorum*, DeG., the adult of which is described, is common in Japan, its life-history being similar to that of *F. centralis*, Mats. [*cf. R.A.E.*, A **23** 43]. The larvae infest various edible fungi, preferring *Armillaria mellea*, *Boletus elegans* and *Pholiota*. The larval and pupal stages lasted for about a week each in October in Hokkaido, pupation occurring in the soil.

Yokoo (T.). **Notes on *Chlorops oryzae*, Mats., in Korea.** [*In Japanese.*] —*Oyo-Dobutsugaku Zasshi* **8** no. 2 pp. 99–105, 3 figs. Tokyo, May 1936.

In 1935, *Chlorops oryzae*, Mats., all stages of which are described, caused serious damage to rice in Japan, and also occurred in large numbers in Korea. In Korea, there are 3 broods annually, the winter being probably passed in the larval or pupal stage. The adults emerge in May, mid-June and September and oviposit on the leaves and stalks of rice. The larvae mine in the leaves, and some of the older ones bore into the stalks. They pupate in the plant, and the adults emerge at night. The most serious damage is done to the seedlings in spring. The Braconids, *Dacnusa* sp. and *Biosteres* sp., parasitise the larvae or pupae.

Mishima (R.). **Results of the Studies on the Biology and Control of** *Rhaphidopalpa femoralis*, **Motsch.** [*In Japanese.*]—*Nara agric. Exp. Sta. Extra Rep.* no. 5, 170 pp., 16 pls. Nara, Japan, February 1936.

The Galerucid, *Rhaphidopalpa femoralis*, Motsch., all stages of which are described, is widely distributed in Japan, the Loochoo Islands and Korea, between 25 and 40·5°N. Lat. It has one generation a year north of the isothermal line of 16°C. [60·8°F.], and two or more south of it. It was recorded as a pest in Japan as long ago as 1696. In this paper are recorded the results of studies in the Nara Prefecture (central Japan), where it is very destructive to water-melons [*cf. R.A.E.*, **18** 591]. The overwintered adults first feed on beans (*Vicia faba*), *Callistephus chinensis* and *Erigeron annuus*, but attack the leaves, stalks and fruits of cucurbits from May onwards. They are polyphagous and have been found on 69 species of plants of 19 different families, but young adults that have not fed on cucurbits for at least one month before hibernation, are unable to survive the winter. The females pair more than once and lay about 670 eggs after each fertilisation, beginning to oviposit about the end of May. The eggs are laid on or in the soil and hatch in 10–16 days. They are not killed by submergence in water for 2 or 3 days. The larvae feed on cucurbits only, attacking the roots and, when full grown, boring into the stalks. They usually fail to complete their development on *Luffa* or *Momordica*. The larval stage lasts about a month, and the pupal a week. The adults, which emerge in late July and August, are inactive at night and on cloudy days. They begin to feed at 22–23°C. [71·6–73·4°F.] but do so chiefly at 27° or 28°C. [80·6° or 82·4°F.]. Occasionally they feed on the juice of ripe fruits and the secretions of the Coccid, *Ceroplastes rubens*, Mask. They enter hibernation in sheltered places and on the south sides of hills from late October. On warm days in winter they sometimes emerge and feed, but die if overtaken by cold. Few are killed by natural enemies, which include the fungus, *Beauveria bassiana*.

Cucurbits can be protected from the adult beetles by screening, and to some extent alleviating the damage done by Galerucids by growing wheat round them. Lead arsenate, a derris dust and nicotine are effective insecticides; derris also kills the eggs and stimulates the growth of the plants.

Glover (P. M.) & Chatterjee (K. C.). **A preliminary Note on the Bionomics and Economic Importance of** *Microbracon hebetor* **Say, a Braconid new to North India.**—*Proc. Indian Acad. Sci.* **3** no. 3 pp. 195–211, 1 pl., 2 figs., 14 refs. Bangalore, March 1936.

Microbracon hebetor, Say, was first recorded from India (as a parasite of *Corcyra cephalonica*, Stn.) in 1934 [*R.A.E.*, A **22** 488], though a first record was erroneously claimed later [**23** 248] when adults were found in a room where samples of lac were stored. It occurs in Ceylon, where it attacks *C. cephalonica*, *Ephestia kuehniella*, Zell., *E. cautella*, Wlk., and *Sitotroga cerealella*, Ol. Additional hosts in other parts of the world include *E. elutella*, Hb., *Plodia interpunctella*, Hb., *Galleria mellonella*, L., and *Pyralis farinalis*, L. The possibility of inducing it to attack *Platyedra gossypiella*, Saund. [*cf.* **16** 467] in India is under investigation. It was induced in the laboratory to oviposit on the

larvae of this moth. When caged with them, it was found to be an ectoparasite of the larvae of *Holcocera pulverea*, Meyr., *Eublemma amabilis*, Moore, and *E. scitula*, Ramb., which are predacious on the lac insect [*Laccifer lacca*, Kerr], though *E. scitula* is beneficial rather than harmful as it chiefly attacks injurious Coccids. The technique of breeding *M. hebetor* in the laboratory is described, and an account given of its methods of oviposition. Eggs laid by unfertilised females yielded males only while those of fertilised females gave approximately equal numbers of both sexes. The average number of eggs laid on a larva was 8 on *E. amabilis*, 6 on *H. pulverea* and 5 on *E. scitula*. Females sometimes stung and fed on larvae without laying any eggs on them. In most cases the host larvae offered were in the final instar. In the case of *E. amabilis*, eggs were laid also on larvae in the 8th and 9th instars and in 2 cases on early prepupae. Fertilised females that died after the oviposition period laid an average of 36·5 eggs, and their average longevity was 7 days. The average longevity of unfertilised females that oviposited was 17 days and of males 3 days. The egg stage lasted 1–2 days, the larval 5–9, the pupal 3–7 and the total life cycle 10–18.

Since the adults of both sexes can squeeze through very small spaces, escapes from the breeding cages were numerous, and failures to oviposit and mortality among the early stages were high. These disabilities will probably be reduced with improved breeding technique and with acclimatisation to *E. amabilis* and *H. pulverea* as hosts. The parasite is believed to be potentially ideal for acclimatisation and introduction in lac-growing areas.

Plagas del campo. Memoria del Servicio fitopatológico agrícola. III. Año 1934. [Agricultural Pests and Diseases. Memoir of the Phytopathological Service. Year 1934.]—Med. 8vo, 348 pp. Madrid, Minist. Agric., 1935. [Recd. May 1936.]

This annual report includes notes on the plant pests and diseases observed in 1934 (a section being devoted to locusts) and reports on plant inspection and experimental work in various parts of Spain.

Melis (A.). **Contributo alla conoscenza morfo-biologica della** *Polia* (*Mamestra*) *pisi* **L.**—*Redia* **22** pp. 1–31, 20 figs., 4 pls. Florence, 25th April 1936. **Contributo alla conoscenza morfo-biologica della** *Barathra* (*Mamestra*) *brassicae* **L.**—*T.c.* pp. 33–34, 12th May 1936.

In the second paper it is stated that the Noctuid dealt with in the first had been misidentified for the author as *Polia pisi*, L., and was in fact *Barathra brassicae*, L. In Italy the larvae of the first generation skeletonise the leaves of peas and cause a marked reduction in the crop. Detailed descriptions are given of the morphology of the egg, newly hatched and mature larvae, pupa and adults of both sexes. Biological observations were made in Tuscany in 1933–35. The first adults appeared early in May and oviposited on the leaves of peas, poppy (*Papaver somniferum*) and an exotic leguminous plant, *Dielytra spectabilis*. The eggs were laid in batches of 18–282 and hatched in 3–4 days. The larvae were gregarious at first, but separated after a few days. They usually fed by night and were distinctly cannibalistic. The pupal stage lasted from about 10 days to 2 months. All the data

obtained apply to the spring-summer generation, but the autumn-winter generation is well known as a pest of cabbages. Large numbers of the eggs were parasitised by *Trichogramma* (*Oophthora*) *semblidis*, Aur., two adults of which usually emerged from each host egg. No other parasite was observed during this work, but lists of those recorded in Italy by other authors from *P. pisi* and *B. brassicae* are given in the first and second papers respectively.

L'Action de l'Office régional agricole du Midi de 1919 à 1936.—Med. 8vo, 204 pp., 1 fldg table. Marseille, 1936.

In the course of this review of the work of the Regional Agricultural Office of the Midi, which closed in 1936, summaries are given (pp. 186–192) of the measures employed against locusts in the south of France during the invasion of 1920–22 [*cf. R.A.E.*, A **9** 300, 403; **11** 470], and against the Argentine ant [*Iridomyrmex humilis*, Mayr], which became a serious pest following its introduction previous to 1908 [*cf.* **9** 56, etc.].

Schulze (K.). **Weizenwanzen-Schaden an Getreide.** [Injury to Cereals by Wheat Bugs.]—*Mitt. Ges. Vorratsschutz* **12** no. 3 pp. 25–27, 5 refs. Berlin, May 1936.

In 1935 serious injury was caused to wheat in Germany by *Eurygaster maura*, L., *Aelia acuminata*, L., and *A. rostrata*, Boh. These Pentatomids are indigenous and have very similar bionomics. The adults hibernate under moss and in tufts of grass and oviposit in spring. The young nymphs chiefly occur in dry, sunny places on grasses, Umbelliferae and Compositae. The bugs feed on soft, juicy parts of plants, so that the grains of wheat are attacked only when milky. The injury causes a great reduction in the quality of the gluten, and the resultant flour is unsuitable for baking [*cf. R.A.E.*, A **22** 332]. Outbreaks, however, only occur at long intervals, probably depending on weather conditions.

Wichmand (H.). *Caradrina quadripunctata* **als Schädling in Häusern.** [*C. quadripunctata* as a Pest in Houses.]—*Mitt. Ges. Vorratsschutz* **12** no. 3 pp. 28–31. Berlin, May 1936.

Three cases are recorded of serious injury to clothing in houses in Denmark by *Athetis clavipalpis*, Scop. (*Caradrina quadripunctata*, F.). The larvae attacked woollen, cotton and artificial silk materials, but not linen. In all three instances, the injury occurred in summer in houses that had been thatched with *Phragmites* or rye straw in the preceding winter or spring. It was stated locally that the larvae of this Noctuid only appear in a house during the first summer after a new thatch has been put on.

Speyer (W.). **Die an der Niederelbe in Obstbaum-Fanggürteln überwinternden Insekten. VI. Mitteilung: Lepidoptera.** [Insects hibernating in Fruit-tree Trap-bands in the Lower Elbe Districts. Sixth Communication.]—*Z. PflKrankh.* **46** no. 1 pp. 13–27, 10 figs., 13 refs. Stuttgart, 1936.

In this sixth paper of a series [*cf. R.A.E.*, A **23** 704], an annotated list is given of 15 species of Lepidoptera found between 1926 and

1932 in shelter bands on fruit trees. Of these only two, *Cydia pomonella*, L., and *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuess.), are of economic importance. Including summer records, 61 species of Lepidoptera have been noted on fruit trees in the orchard districts of the Lower Elbe.

RIGGERT (E.). **Studien über den jährlichen Generationscyclus von *Oscinella frit* L. in Schleswig-Holstein.** [Studies on the annual Cycle of generations of *O. frit* in Schleswig-Holstein.]—*Z. Pfl-Krankh.* **46** no. 3–4 pp. 171–203, 3 graphs, 2 pp. refs. Stuttgart, 1936.

The number of generations of *Oscinella frit*, L., that occur in a year depends on environmental factors, especially temperature. Published data on the subject is briefly reviewed, and a detailed account is given of studies in the field and under experimental conditions in Schleswig-Holstein to ascertain the position in Germany. In 1928–32 weekly catches were made in fields under different cereals and other crops, and the results, which are shown in tables and graphs, are discussed. In all years there were 3 generations, and this was confirmed by insectary observations. The date of adult emergence in spring is of decisive practical importance, and a fairly useful indicator of it was found to be afforded by the blossoming of dandelion plants and, for the beginning of the main flight, the blossoming of the earliest varieties of apple. The adults may, however, appear a little in advance of the blossoming of these two plants if the preceding autumn has been unusually warm. The development of the first generation from egg to adult was completed in about $1\frac{1}{2}$ months on winter barley in the ear, but required at least a week more on oat seedlings. The temperature in the barley ears was possibly higher than in the oat seedlings. It is concluded that in Schleswig-Holstein *O. frit* has normally 3 generations that overlap only slightly. The adults of the first appear at the end of June (rarely early in July) and are in flight until the middle or end of August, with a peak in late July or early August. Those of the second occur from early August to mid-October with a peak in early September. The larvae of the third hibernate and pupate in the following April and May, the adults having a flight period from early or mid-May (rarely late April) to the end of June, with a maximum from the end of May to early or mid-June.

ABRAHAM (R.). **Wanzen (Heteroptera) an Obstbäumen. IV. Mitteilung. *Orthotylus marginalis* Reut. (Hemiptera-Heteroptera) an der Niederelbe.** [Bugs on Fruit Trees. Fourth Communication. *O. marginalis* in the Lower Elbe Districts.]—*Z. PflKrankh.* **46** no. 5 pp. 225–240, 5 figs., 25 refs. Stuttgart, 1936.

The bugs found on fruit trees on the Lower Elbe [*cf. R.A.E.*, A **23** 704, etc.] include *Orthotylus marginalis*, Reut., the distribution of which in Germany is recorded from the literature and personal observations. This Capsid was easy to breed, though many of the nymphs succumbed to a disease. The sexes were equal in numbers. The nymphs and adults occurred on the young shoots and leaves of the food-plants, which included apple and currant, but caused no injury to them, feeding chiefly on Aphids both in the field and in the laboratory. In the laboratory the number of Aphids eaten daily was 2–3, 4 and 6 for the 3rd, 4th and 5th instars respectively, and 3 for the adult.

No natural enemies of importance were observed, except in one locality where 70–80 per cent. of the eggs laid on currant shoots were destroyed by a Hymenopterous parasite.

Peters (G.). **Chemie und Toxikologie der Schädlingsbekämpfung.** [The Chemistry and Toxicology of Pest Control.]—*Samml. chem.-tech. Vortr.* N.F. Heft 31 120 pp., 22 figs. Stuttgart, F. Enke, 1936. Price, paper, *M.* 6.90; in Germany, Switzerland and Palestine *M.* 9.20.

The author points out that the successful control of pests depends on the co-ordination of technical, chemical and biological experience, and that he has written this work, which deals almost entirely with the control of insects, primarily from the standpoint of chemistry, the biological and economic sides being considered only to the extent justified by their relation. Figures are given showing the production and consumption of the chief insecticides in various parts of the world, and some typical pests are listed with indication of the situations in which they occur, the nature of the injury and the appropriate remedy. Other chapters deal with the principles to be followed in testing insecticides, the chief chemicals used (with their better known commercial brands), the characters of toxic action, the comparison of toxic values, the enhancement of toxic effect by combination, and the apparatus evolved for testing.

[Lindeman (I. V.) & Kuz'min (N. A.).] **Линдеман (И. В.) и Кузьмин (Н. А.). The Development and Distribution of Weevils that injured Beet in the Years 1933–34 in the Part of the Ukraine on the right Bank of the Dnieper.** [*In Russian.*]—*Trud. kievsk. (mironovsk.) s.-kh. op. Stantz.* 1935 no. 1 (6) pp. 3–51, 4 graphs, 7 maps. Kiev, 1936.

On the basis of investigations in 1933 and the spring of 1934, the authors show in great detail the distribution of the beet weevil, *Cleonus* (*Bothynoderes*) *punctiventris*, Germ., and the sainfoin weevil, *Tanymecus palliatus*, F., in the part of the Ukraine west of the Dnieper, where sugar beet is extensively cultivated and is severely damaged by both weevils. Owing to unusually cold weather in 1933, their development was retarded by 1½ months. The meteorological conditions of the year are reviewed. The mass appearance of the overwintered adults of *Cleonus* did not take place till 10th–15th May, and their emergence was very protracted, some remaining in the soil till autumn. Oviposition lasted from about mid-May till August, the peak being reached in the second half of June. The larval stage lasted 80–90 days, as against an average of 54 in normal years. The first pupae of *T. palliatus*, the life-cycle of which is completed in about two years, were only found from the beginning of August.

[Bezverkhiĭ (I. F.) & Charkovskiĭ (M. P.).] **Безверхий (И. Ф.) и Чарковский (М. П.). Shallow Ditches as a Method of controlling the Beet Weevil.** [*In Russian.*]—*Trud. kievsk. (mironovsk.) s.-kh. op. Stantz.* 1935 no. 1 (6) pp. 52–68, 1 diagr., 8 refs. Kiev, 1936.

A detailed account is given of field experiments carried out in western Ukraine in the summers of 1933 and 1934 to test the effectiveness against the beet weevil [*Cleonus punctiventris*, Germ.] of shallow

and narrow trap ditches (about 5 ins. deep and 3½ ins. wide) and compare it with that of the ditches commonly used which are 14 ins. deep and 10 ins. wide. The ordinary ditches are usually dug in spring round the beet fields of the previous year to prevent the overwintered weevils from migrating to new plantations, and much of the work is often wasted, since the weevils are unevenly distributed over the field and numbers of them are trapped in some parts of the ditch, while hardly any are found in other parts for distances of many hundreds of yards. On the other hand, the small size of the shallow ditches makes it possible to arrange them in a network in the field itself, thus bringing them close to the places where the hibernating weevils are concentrated. By using a special small plough, large areas could be covered quickly and the line of ditches could be changed according to the direction of the migrating weevils. Moreover, the weevils were easier to collect from the shallow ditches, in which trap pits were dug at intervals. The results of the investigations are tabulated. In an experiment in a large beet field in the spring of 1933, two equal areas, each of 46½ acres, were surrounded with ordinary deep ditches, the total length of which was just over 1,405 yards. The ditch round the first area had 122 trap pits and that round the second 112. The second area was also covered with a network of shallow ditches about 110 yards apart. Their total length was about 4,300 yards and they contained 828 trap pits. About 62 lb. of weevils were taken in the ditch round the first plot, about 42 lb. in that round the second, and about 116½ lb. in the shallow ditches.

In further experiments, a network of shallow ditches proved to be effective against the sainfoin weevil [*Tanymecus palliatus*, F.], catching 10 times as many as the ordinary deep ditch round the beet field. Good results against *Cleonus* were also obtained in plantations of young beet, when the shallow ditches were dug at the end of May to trap the weevils that had overwintered in the field and were about to attack the young plants.

Special investigations showed that the trap pits dug in the ditches need not be more than 14 ins. deep if they are about 14 ft. apart and are cleared of the weevils every day [*cf.* next paper]. More weevils were caught, however, if the pits were only 6½ ft. apart.

[Bezverkhiĭ (I. F.).] **Безверхий (И. Ф.). Eliminating the Necessity for Removal of the Beet Weevils from cylindrical Trap Pits.** [*In Russian.*]—*Trud. kievsk. (mironovsk.) s.-kh. op. Stantz.* 1935 no. 1 (6) pp. 75–79. Kiev, 1936.

Proper construction of the trap pits in the shallow trenches used for the control of the beet weevil [*Cleonus punctiventris*, Germ.] in the Ukraine [see preceding paper] is of importance. If deep enough, the best type of pit is a round hole with smooth vertical walls, made with a special drill and measuring about 5½ ins. in diameter, as it is practically impossible for the weevils to escape. The depth of the pits should depend on the number of weevils likely to be caught, but 14 ins. is enough if the weevils are removed daily. At this depth the temperature and humidity are such that the weevils are more or less inactive and do not attempt to fly. If the pits are not cleared daily, they should be 20 ins. deep, or some fumigant should be placed in them to kill the weevils. For this purpose experiments were made

in May 1934 with a preparation in the form of a dust or flakes containing 30–32 per cent. hydrocyanic acid. The powder and flakes proved equally effective. Counted numbers of weevils were placed in cylindrical pits 14 and 20 ins. deep and containing from 1 to 5 gm. of the fumigant. A table shows the percentage mortalities after each 24 hours for 3 days. The effectiveness of the poison showed a marked decrease from the second day onwards, particularly in the shallower pits, so that in practice it would have to be renewed every third day for the whole period that the weevils are being trapped, which usually lasts about a month. In all the tests with dosages of 2–4 gm. per pit, the percentage of mortality was always 90 or more but never 100. With 5 gm. it was 100 on the first day and 97 on the second in the shallower pit and 92 and 94, respectively, in the deeper one.

[Kuz'min (N. A.).] **Кузьмин (Н. А.). Contribution to the Question of the Distribution of the Beet Weevil in Fields used in Crop Rotation for Crops other than Beet.** [*In Russian.*]—*Trud. kievsk.* (*mironovsk.*) *s.-kh. op. Stantz.* 1935 no. 1 (6) pp. 69–74. Kiev, 1936.

Investigations in western Ukraine in 1928–31 showed that the beet weevil [*Cleonus punctiventris*, Germ.] breeds in considerable numbers on chenopodiaceous weeds in fields under crops other than sugar-beet. The emergence of the overwintered adults is very protracted [*cf. R.A.E.*, A **19** 428], and repeated examinations in 1928 of the soil in fallow land showed that 73 per cent. of the weevils remain in the soil to hibernate a second time; similar cases were also observed in fields of different crops that had been used for beet in the previous year. The findings of other workers that some of the weevils do not migrate to beet but breed on chenopodiaceous weeds were confirmed in experiments in which *Amarantus retroflexus*, *Chenopodium* spp., *Atriplex hortensis* and *A. nitens* were sown in plots surrounded by beet. The weevils attacked the weeds so severely that some of them had to be resown, and oviposited on them, particularly on *Amarantus retroflexus* and *Atriplex hortensis*, which were found to harbour 45·7 and 27·4 per cent. respectively of the number of weevils occurring on a corresponding area of the surrounding beet.

[Zabolotskaya (O. K.).] **Заболотская (О. К.). A Description of the Stages of Development and Biology of the Beet Pigmy Beetle (*Atomaria linearis* Steph.).** [*In Russian.*]—*Trud. kievsk.* (*mironovsk.*) *s.-kh. op. Stantz.* 1935 no. 1 (6) pp. 80–85, 8 figs. Kiev, 1936.

The Cryptophagid, *Atomaria linearis*, Steph., is an important pest of beet in the Ukraine, and laboratory and field observations on its bionomics were carried out in 1931. It was found very difficult to rear in the insectary, but all stages were obtained and are described. A brief account of the life-history is given [*cf. R.A.E.*, A **22** 387, etc.]; there is one generation a year, the adults hibernating in the upper layer of the soil in beet-fields. The egg, larval and pupal stages lasted 5–6, 33–37 and 13–16 days, respectively. In the insectary, 10–24°C. [50–75·2°F.] was the optimum temperature for the beetles, and they died in numbers at 35°C. [95°F.]. Pairing started on 7th May, but fully developed eggs were not found in females before 22nd

June. Usually only one egg at a time was completely mature. Females with undeveloped eggs occurred simultaneously with the mature ones, and the period of oviposition was very protracted, lasting till September ; in the laboratory eggs were laid even in winter. Apparently, a female lays a total of not more than 20 eggs. Maximum oviposition occurred in the second half of July. The adults live a considerable time, mortality only becoming apparent in August, but all the old beetles die in the course of September and October. Maximum feeding takes place in April and May. In the insectary, young adults emerged in September, but in the more southern districts they occurred in the field as early as July.

Infestation of beet by *A. linearis* is invariably accompanied by fungous diseases, but in experiments adult beetles that had been kept in contact with, and had fed on, cultures of *Fusarium* and *Phoma* did not infect beet with these fungi. Beetles kept with cultures of *Penicillium* soon died. It appears, therefore, that *A. linearis* does not transmit the fungi, but contributes to their spread by making open wounds in the beet, into which they penetrate from the soil.

WHELAN (D. B.). **A Key to the Nebraska Cutworms and Armyworms that Attack Corn.**—*Res. Bull. Neb. agric. Exp. Sta.* no. 81, 27 pp., 9 figs., 19 refs. Lincoln, Neb., June 1935. [Recd. May 1936.]

A key is given to the larvae of 23 species of Noctuids injurious to maize, in Nebraska or neighbouring States. It is based on structural characters, supplemented by colour. The larva of each species is described shortly, with brief notes on its seasonal abundance, habits, food-plants and distribution in America.

MUNRO (J. A.). **Entomology.**—*Bull. N. Dak. agric. Exp. Sta.* no. 286 pp. 63–68, 1 fig. Fargo, N. Dak., November 1935. [Recd. May 1936.]

An account is given of work on insect pests in North Dakota during the four years ending June 1935, including *Prionoxystus robiniae*, Peck, on green ash [*Fraxinus lanceolata*] [*R.A.E.*, A **24** 11]. *Barathra configurata*, Wlk., has practically disappeared since 1929 [*cf.* **19** 205] ; and, owing to the distribution of bait for grasshoppers *Gryllulus* (*Gryllus*) *assimilis*, F. [*cf.* **20** 640], has decreased in numbers. Infestation by grasshoppers increased from 1930 to 1934, when it was checked by a poisoning campaign. It is recommended that poisoning should be begun over the natural breeding grounds of the species involved before they become abundant and migrate. Experiments showed that sugar-beet molasses and cane molasses were about equally attractive in baits for *Melanoplus bivittatus*, Say. When sawdust (at least one year old) was substituted for 50 per cent. of the bran in a bait mixture containing crude white arsenic, the efficiency was reduced by 10–12 per cent., but preliminary observations indicated that the use of sodium arsenite instead of white arsenic reduced the amount of molasses necessary and more than compensated for the effect of the sawdust. The substitution of oat husks for bran reduced the attractiveness of the bait by more than 60 per cent. Sugar-beet pulp was slightly more attractive than bran, but was difficult to use owing to the size of the particles, and their slow absorptive rate. As a poisoning agent,

3 per cent. sodium fluosilicate was as effective as 5 per cent. crude arsenic. Dusts, including sodium and barium fluosilicate and sodium fluoride, and arsenical sprays were much less effective than baits. In the early summer of 1932, *M. bivittatus* constituted 85 per cent. of the grasshoppers in the east of the State, the remainder including other local species. These were controlled by baits, but *M. mexicanus*, Sauss., and *Camnula pellucida*, Scudd., migrated from untreated areas and laid eggs, so that in 1933 the district was reinfested.

Bourne (A. I.) & others. **Department of Entomology.**—*Bull. Mass. agric. Exp. Sta.* no. 327 (Ann. Rep. 1935) pp. 39–54. Amherst, Mass., February 1936.

Results of recent experiments on various pests are summarised in this account of work in Massachusetts during the year ending 30th November 1935.

As contact sprays against the gladiolus thrips [*Taeniothrips simplex*, Morr.], derris preparations and aliphatic thiocyanates (Lethane 420) were about equal in value and superior to nicotine sulphate or pyrethrum. The heaviest damage by the thrips occurred to a purple, and the lightest to a white variety of *Gladiolus*, but colour can have little to do with its abundance, since two varieties of a similar pink had average populations of 8·5 and 59·3 thrips per bud. Two newly developed pyrethrum products, designated DX75 (pyrethrum) and DX57 (pyrethrum-nicotine), applied at a dilution of 1 pt. in 100 gals. water were effective against the white apple leafhopper [*Typhlocyba pomaria*, McAtee], one application giving about 95–97 per cent. reduction of infestation in two orchards, and, unlike nicotine sprays, they could be applied on cloudy, cold or even rainy days. Dusting summer squash and canteloupe against the striped cucumber beetle [*Diabrotica melanocephala*, F.] was necessary whenever the beetles became abundant, when more than 2 ins. of new growth were made, and after heavy rains. Adequate control resulted from 5 treatments with any of the following dusts : commercial derris mixtures (0·55 per cent. rotenone content) ; mixtures of derris and clay with and without 40 per cent. sulphur (to give 0·6 per cent. rotenone) ; a 30 : 70 pyrethrum and clay mixture ; and a 10 : 20 : 70 mixture of calcium arsenate with monohydrated copper sulphate and lime. In field tests against the squash vine borer [*Melittia satyriniformis*, Hb.], good control was obtained from four applications of a dust of derris and clay (0·6 per cent. rotenone), and from sprays of summer oil with nicotine sulphate [*cf. R.A.E.*, A **23** 654]. Cabbages were completely protected from injury by the larvae of the cabbage fly [*Phorbia brassicae*, Bch.] by treatment with mercury bichloride solution (1 oz. in 10 U.S. gals. water) directly the eggs were found, and again a week later. Promising results were obtained by rolling the plants as they were taken from the seed bed in a dust of mercurous chloride (calomel) and gypsum until the roots and stems were thoroughly coated. Dusts containing 50 and 20 per cent. mercurous chloride applied in this way gave 79 and 73 per cent. protection respectively, and the plants made good growth, but dusts containing 4 and 8 per cent. mercurous chloride were less effective. The most promising of the resistant varieties of onions in the tests of 1934 [*cf.* **23** 655] again showed fewer thrips [*Thrips tabaci*, Lind.] per plant than did the standard variety grown in the district.

Further experiments on the influence of soil conditions and of exposure on the emergence of adult apple maggot flies [*Rhagoletis pomonella*, Walsh] gave similar data to those obtained in 1934 [**23** 655]; 17 per cent. fewer flies emerged than in 1934 and 3–7 days later, under similar conditions. No new introductions of *Macrocentrus* [*ancylivorus*, Rohw.] were made against the oriental fruit moth [*Cydia molesta*, Busck] in peach orchards, since the latter was greatly reduced in numbers by the severe winter. Mid-season collections of infested twigs showed that *Macrocentrus* had survived the winter. Experiments in which potatoes were sprayed with insecticides in Bordeaux mixture or Bordeaux mixture alone indicated that a product containing rotenone is of value for the control of the leafhopper [*Empoasca fabae*, Harr.], and also gives a high immediate mortality of the flea-beetle [*Epitrix cucumeris*, Harr.], though calcium arsenate affords more lasting protection against the latter.

In a large rose house slightly infested by the rose leaf-roller (*Platynota stultana*, Wlsm.), 801 examples of this moth were caught in 42 nights by a light-trap having a clear glass bulb, and 576 by one having a blue bulb that gave daylight blue light. In continuation of experiments [*cf.* **23** 655] with light-traps for the codling moth [*Cydia pomonella*, L.], the efficiency of the water pan was increased by placing a film of oil on the water and by raising the bulbs approximately 5 ins. higher. General notes are given on the kinds and numbers of insects caught, and it is concluded that the traps furnish an accurate index of the emergence rates of different species and their relative abundance from year to year. Most insects, including *C. pomonella* were more attracted by high frequency colours, particularly blue, but Noctuids were most attracted by red.

Only two significant generations of *Dasyneura mali*, Kieff., occurred on apples in 1935 [*cf.* **22** 399; **23** 655], and over 80 per cent. of the larvae collected in July did not transform in the current season. Pupation in the overwintering cocoons began in the warm spring weather, and the average pupal period was 9·75 days. At least 0·3 in. of rain was necessary to cause noticeable migration of the mature larvae from the rolled leaves. It was found that about 80 per cent. drop to the ground and about 20 per cent. crawl down the branches and trunk. The addition of nicotine sulphate 1 : 800 to the regular calyx spray reduced the number of eggs and larvae somewhat, but not the number of infested buds. Corrugated paper bands treated with beta-naphthol killed all the larvae that entered them. The most timely applications of two sprays of lead arsenate and fish oil against the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apples were made on 3rd and 15th June, while the most effective single spray was applied on 7th June. The weevils emerged in numbers during the petal fall period, and their activity was unusually prolonged owing to cool wet weather.

Cryptolaemus montrouzieri, Muls., was used for the control of mealybugs on *Gardenia* in commercial greenhouses in 1934 and 1935. In both years a large second generation of larvae practically eliminated the mealybugs on the aerial parts of the plants, but a few survived at the base of the stems where they were protected by soil and mulch so that reinfestation gradually occurred during the summer. In experiments, the average number of eggs laid by a female of *Cryptolaemus* was 63 at 80°F., 61 at 70° and only 24 at 60°. The incubation periods at these temperatures averaged 4·55, 8·28 and 13·7 days

respectively. Observations of the activity of the larvae when fed on mealybug eggs showed that 70 and 80° were favourable temperatures, but that control would not be obtained at 60°. Studies of the influence of temperature on the effectiveness of sprays against the red spider [*Tetranychus telarius*, L.] were made at 60, 70 and 80°F. Poor results were obtained with miscible pine oil and with pyrethrum extracts, but a commercial product containing pyrethrum combined with derris or cubé [*Lonchocarpus*] extractives in alcohol gave an excellent kill. The mortality increased about 5 per cent. with each increase of 10 degrees in temperature, and about 10 per cent. when the dilution was decreased from 1 : 400 to 1 : 200. Another product, containing 1·5 per cent. rotenone in acetone, gave good control at 80°F., but showed a 20 per cent. decrease in mortality at 60°F. A solution of the flake form of pine-tar soap was also effective at the rate of 8 lb. in 100 U.S. gals., but not at lower concentrations. In general, the effectiveness of soap sprays was greater at 60°F. than at 80°.

Good (N. E.). **The Flour Beetles of the Genus** *Tribolium*.—*Tech. Bull. U.S. Dep. Agric.* no. 498, 57 pp., 22 figs., 108 refs. Washington, D.C., March 1936.

In the first half of this paper are given a key to the seven species of *Tribolium* (*castaneum*, Hbst., *confusum*, Duv., *madens*, Charp., *destructor*, Uyttenb., *gebieni*, Uyttenb., *indicum*, Blair, and *myrmecophilum*, Lea) and descriptions of the first four, which are those of economic importance, together with an account of their history and synonymy and the materials they attack. Of these *T. destructor* has been recently taken as a pest in seeds and various cereal products in Germany and Holland [*R.A.E.*, A **22** 229; **23** 524]. *T. madens* has been found from time to time in Europe and the United States in rotting wood or other situations where it was of no economic importance, but it has been recorded as attacking flour and cereal products in Russia and in several instances in the United States, and as occurring in stores in Egypt.

The remainder of the paper comprises details of the life-history of *T. castaneum* and *T. confusum* based on personal observations and the literature, followed by brief notes on the natural enemies of the beetles of this genus and on measures for their control. Some of the author's observations have already been noticed [**21** 314]. The larval period ranged from 22 to over 100 days, according to the environment, and the optimum temperature for development seemed to be about 30°C. [86°F.]. Whole-wheat flour, middlings, bran, maize meal and white flour were favourable to development in that order. *T. castaneum* can fly short distances, but *T. confusum* has not been observed in flight, although it has wings. The average longevity of the adults of *T. confusum* and *T. castaneum* used in oviposition experiments was 634 and 547 days respectively for males, and 447 and 226 days for females, but beetles have been known to live 3 years 271 days. No females older than 459 days laid fertile eggs. The average oviposition period of *T. confusum* was 8 months, and of *T. castaneum* about 5½ months, while the total number of eggs averaged 458 and 327 respectively. The two species seemed equally resistant to starvation, and resistance varied inversely with the temperature. The longest survival periods for adults without food were 18 days at 30°C., 23 at room temperature, 27 at 15°C. [59°F.], and 51 at 10°C.

[50°F.] ; the maximum survival periods for larvae without food at the first three temperatures were 23, 46 and 54 days respectively. In April 1933 numbers of the Anthocorid, *Xylocoris cursitans*, Fall., were observed in a breeding jar containing *T. confusum* in cracked grain and flour collected from a mill in Washington, D.C., in December 1932. This bug is generally predacious on small soft-bodied insects, and in this case was undoubtedly attacking the small larvae.

Fenton (A.). **The Use of Sulphur in the Control of Truck Crop and Cane Fruit Insects and Diseases.**—Demy 8vo, 86 pp., 63 refs. Houston, Tex., Texas Gulf Sulphur Co. [1936.]

This work, which is compiled from the literature, deals with the uses of sulphur, alone or in combination with other materials, in the control of pests and diseases of vegetable crops and cane fruits in the United States. The pests are arranged under the crops they attack, and notes are given on the insecticides suitable for each. M. D. Leonard and A. Weed contribute a section on uses of pyrethrum and rotenone-bearing dusts with sulphur.

Emerson (A. E.). **Distribution of Termites.**—*Science* **83** no. 2157 pp. 410–411, 5 refs. New York, 1st May 1936.

Referring to a recent record of *Reticulitermes flavipes*, Kollar, at Ithaca (New York) [R.A.E., A **24** 257], which suggests that termites are scarce in the north, the author surveys data of their occurrence from numerous localities along the northern border of the United States. They are now known from every State in the Union and from Vancouver Island, but there is no evidence to indicate that they have been spreading northwards within historical times nor are they increasing markedly in numbers in any locality. There is need for critical data on the abundance of termites in various localities. The northern and southern extreme limits of distribution throughout the world seem to be correlated fairly well with the 50°F. annual isotherm ; in the United States, the northern limit is between the 40 and the 45° annual isotherms. Relative humidity and soil moisture seem to be correlated strikingly with the distribution of certain species. The environmental requirements of termites seem so rigid that it is unlikely that a given species can become established in an environment very different from that in which it is native. A possible exception to the general rule that introduced termites have not spread is the case of *Heterotermes tenuis*, Hagen, a native of Brazil, the Guianas and Panama. It is reported to have been introduced into St. Helena in 1840 and to have damaged houses and furniture, but there is no evidence that it has spread to wild habitats in the Island.

Flanders (S. E.). **A Reproduction Phenomenon.**—*Science* **83** no. 2160 p. 499. New York, 22nd May 1936.

In certain species of parasitic Hymenoptera, particularly those of the Aphelinid genus *Coccophagus*, the males develop only as parasites of Hymenopterous larvae and the females only as parasites of nymphs or adults of Coccids. The Hymenopterous host, however, must be within a Homopterous insect. The production of males in a pure culture of a species having such a habit necessitates the destruction

of the female larvae since they are the only hosts of the male present in the culture. The conditions in which the destruction of the females occurs vary with the species. Apparently in all the species the female is endoparasitic. The male, however, according to the species, may be ectoparasitic, endoparasitic, or both alternately. The male exhibits marked differences in the structure of the respiratory system and other morphological characters. As in other species of Hymenoptera, the male develops from eggs laid by unmated females. These females either deposit their eggs directly on or in the immature Hymenopterous host or in the fluid medium surrounding it. In this medium the eggs remain unhatched until the Hymenopterous host is in a suitable condition for attack.

Carter (W.). **The toxicogenic and toxiniferous Insect.**—*Science* **83** no. 2161 p. 522, 1 ref. New York, 29th May 1936.

The term " toxicogenic " is proposed for insects the feeding of which produces in plants specific toxic (pathological) effects that cannot be ascribed to mere mechanical injury and do not fulfil the criteria necessary to establish the presence of a virus. A toxicogenic insect may, however, not always be capable of secreting toxins, since such toxins may only arise as the result of specific or limited nutritional conditions. To describe the active toxin-secreting condition of a toxicogenic insect the term " toxiniferous " is proposed.

Whitcomb (W. D.). **Naphthalene as a Greenhouse Fumigant.**—*Bull. Mass. agric. Exp. Sta.* no. 326, 31 pp., 5 pls., 21 refs. Amherst, Mass., December 1935. [Recd. June 1936.]

Experiments carried out in Massachusetts on the use of naphthalene as a greenhouse fumigant were based chiefly on its effectiveness against the red spider [*Tetranychus telarius*, L.] on carnations. Most of the tests were conducted in an air-tight chamber (placed in a greenhouse) with a volune of 1,500 cu. ft., good circulation and constant temperature and relative humidity. Lamps and stoves suitable for vaporising melted naphthalene in the average greenhouse are discussed [*cf. R.A.E.*, A **18** 578; **22** 107; **23** 656]. In one apparatus, air heated electrically to about 165°F. is passed over trays of naphthalene crystals, and the concentration of the naphthalene in the atmosphere is controlled by the quantity of crystals exposed and the time of operation. In the experiments, an electric hot-plate was used, surmounted by a frame that supported the dish containing the naphthalene at different heights above the heating unit, so that the amount volatilised could be varied. For all the experiments the quantities of naphthalene are given as oz. per 1,000 cu. ft.

Normal fumigations under favourable conditions did not give reasonable control (85 per cent. dead) until the mites had been exposed for 3 hours or longer to an atmosphere in which at least $\frac{3}{4}$ oz. naphthalene had been vaporised and retained [*cf.* **23** 656]. The vaporisation of $\frac{1}{4}$ oz. naphthalene per hour started to be effective after 3 hours, when the concentration approached saturation, and after 5 hours the mortality was 88 per cent. If the mites were first exposed after 2 hours, when $\frac{1}{2}$ oz. naphthalene had already been vaporised, 85 per cent. were dead after 4 hours, 3 of which were in a nearly saturated atmosphere ; if they were exposed to a saturated atmosphere where 1 oz. naphthalene had been evaporated in 4 hours, 85 per cent. kill was obtained after

3 hours. A 2-hour exposure to an atmosphere in which 1 oz. had been vaporised killed 68 per cent., but only 24 and 34 per cent. were killed by equal exposures to less saturated atmospheres in which $\frac{1}{2}$ or $\frac{3}{4}$ oz. had been vaporised. These results were confirmed by experiments on the effect of the speed of vaporisation of the fumigant. Although under experimental conditions an exposure of 3–5 hours was sufficient, in the average greenhouse 6 hours is necessary.

For the remaining experiments all quantities of fumigant are quoted for an exposure of 6 hours. Newly-laid eggs of the red spider failed to hatch at 75°F. after two or more fumigations with 3 oz. naphthalene, although 89·13 per cent. of untreated eggs hatched. In another test with slightly higher relative humidity, older eggs were killed by one such fumigation, but those laid within 24 hours required four [*cf.* **20** 406]. Examination of the living mites after incomplete treatment showed that the most resistant forms were adult males, nymphs of the second instar and larvae, in that order. The most satisfactory dosage under ordinary greenhouse conditions was 2–3 oz., which gave complete control in two fumigations in the air-tight chamber. With a high relative humidity, $1\frac{1}{2}$ oz. was equally effective ; 1 oz. required three applications. When successive fumigations are necessary, the interval between treatments should not exceed a week. The most tolerant species of plants may be fumigated in the sunlight, but for less resistant species, and in the spring when the foliage is tender, treatment should be given on cloudy days or at night. The efficiency of the fumigation, particularly at the lower rates of application, increased with temperature, between the limits of 72°F. (at which temperature the naphthalene recrystallises) and 95°F. (above which the plants are harmed), and also varied with relative humidity. The best humidity was 75–80 per cent. A series of tests under unfavourable conditions, such as leakage and failure to maintain satisfactory temperatures and humidities, proved that four fumigations with 2 oz. were occasionally necessary for effective control.

Experimental fumigations show that a mixture of naphthalene with 15 per cent. paradichlorobenzene (which can be used safely at 68°F.) did not give results significantly superior to naphthalene alone [*cf.* **20** 406]. Two proprietary liquid fumigants containing aromatic substances related to naphthalene appeared to require comparatively high temperature and humidity for maximum effect (although their vapour does not recrystallise at the lower greenhouse temperatures). Under favourable conditions they were slightly more effective than naphthalene. No injury to carnations resulted when 40 per cent. free nicotine liquid was combined with the naphthalene in the vaporising pan.

Thrips, including *Thrips tabaci*, Lind., *Heliothrips haemorrhoidalis*, Bch. and *Taeniothrips simplex*, Morison, are effectively controlled by naphthalene fumigation, although *Gladiolus*, the food-plant of the last, may be slightly injured. Amongst the Aphids controlled by two fumigations are *Rhopalosiphum* (*Coloradoa*) *rufomaculatum*, Wilson, *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., *Myzus persicae*, Sulz., and *Aphis rumicis*, L., but one fumigation with hydrocyanic acid gas or nicotine is more effective than a single one with naphthalene. Adults of *Trialeurodes vaporariorum*, Westw., are killed, but most of the larvae and pupae survive. *Pseudococcus citri*, Risso, was not controlled, although large numbers were killed. All stages of *Tarsonemus pallidus*, Banks, are resistant to naphthalene fumigation, but three or more fumigations at intervals of 5–7 days controlled *T. latus*, Banks.

The fumigant did not penetrate the soil sufficiently to kill soil-inhabiting insects.

Plant injury (due to the fumigation of intolerant species, variation of conditions during treatment, or improper adjustment of the vaporising apparatus) appeared as white areas of dead but not diseased plant tissue, or as bleached and faded areas on the petals of coloured flowers. Lists are given of 12 common greenhouse plants that are tolerant to naphthalene and 17 that are susceptible. The former include *Begonia*, carnation and cyclamen, and the latter geranium, lilies, rambler rose and tomato. Most other species and varieties are between these classes and should be fumigated only when injury by pests is severe and favourable conditions can be maintained. In experimental plantings, carnations fumigated with naphthalene produced 14–21 more flowers per plant than those receiving regular spraying with water. Chrysanthemums are injured mostly during bud-formation [*cf.* **23** 656]. Cucumber and tomato fruits absorb and retain the odour and taste of naphthalene.

Practical directions are given for the procedure for fumigation, and the cost is discussed.

Hansberry (T. R.) & Richardson (C. H.). **A Design for testing Technique in Codling Moth Spray Experiments.**—*Iowa St. Coll. J. Sci.* **10** no. 1 pp. 27–35. Ames, Iowa, 1935. (Abstr. in *Exp. Sta. Rec.* **74** no. 4 p. 521. Washington, D.C., April 1936.)

An account is given of observations to test the technique of sampling and general plot design for obtaining significant data from the results of spraying experiments against the codling moth [*Cydia pomonella*, L.] on apples in Iowa. " The total crop was counted, worminess being recorded from successive samples of 10 fruits each. From these series of figures, three sets of samples were selected and several analyses of variance were made to test the efficiency of the various methods of sampling. It was concluded that random selection of 300 apples gave an adequate picture of tree infestation. A negative correlation (—0·605) was shown to exist between crop size and percentage of wormy apples on individual trees. The correlation between crop size and worminess on 12 tree tests was significantly smaller (—0·265). Although no significant differences were directly demonstrable between the four tests, when the crop size was considered analysis of variance of the errors of estimate showed significant differences to exist, the test receiving oil-nicotine in the second brood sprays being definitely better than calcium or lead arsenate, and questionably better than manganese arsenate.

Hanson (A. J.) & Webster (R. L.). **The Pea Moth** *Laspeyresia nigricana* **Steph.**—*Bull. Wash. agric. Exp. Sta.* no. 327, 22 pp., 6 pls., 5 figs. Pullman, Wash., April 1936. [Recd. June 1936.]

Cydia (*Laspeyresia*) *nigricana*, Steph., the immature stages of which are described, is now threatening the pea industry in the Whatcom and Skagit counties of Washington, where it first became of economic importance in 1928 and 1933, respectively. It has been recorded also in Michigan, Wisconsin, New York, eastern Canada and British Columbia. Its importance varies considerably, and in Wisconsin and Michigan it is now considered a minor pest.

The food-plants, in order of preference, are peas, sweet peas (*Lathyrus*), vetches (*Vicia*) and other leguminous plants. The eggs are laid promiscuously on them during June, July and August, and hatch in about 8 days. The larva eats its way through the pod and feeds on the seeds, moving from one to another. When there are two or more larvae in the same pod, one usually kills the others. The feeding period varies from a minimum of 19 days (in peas) to a maximum of 35 days (in vetch), after which the larva bores out of the pod, drops to the ground and spins a cocoon in the soil at a depth of $\frac{1}{2}$–$3\frac{1}{2}$ ins. The larvae remain in their cocoons until ready to pupate, usually in the following year, in which case the moths emerge 10–$11\frac{1}{2}$ months later; some, however, complete their development and the moths emerge from 12 days to 3 months after the completion of the cocoon, giving rise to a partial second generation. Before a larva pupates it cuts the cocoon and moves to the surface of the soil. The pupal stage lasts about 12 days. In experiments in 1935, moths from overwintering larvae emerged from 1st June to 25th July, with maximum emergence during July. Those from the first generation larvae that transformed started to emerge in late July and continued through the autumn. The moths are most active during the afternoon when the temperature is highest. They do not migrate but remain on plants round the field, whether food-plants or not.

Peas are grown in Washington for shipping to the fresh vegetable markets, for canning and for the seed and split pea trade, and each phase of the industry is differently affected. Late varieties suffer more than the early ones, as the peas are maturing through the entire flight period of the moths. Under experiment in 1934, the garden varieties of the Alderman group, which mature slowly, showed 20–45 per cent. infestation, while the canning varieties showed only 5 per cent. In 1935 there was 100 per cent. infestation in late July. Varietal differences were slight and early planting was shown to be of but little use when the moths were present in large numbers.

In the case of peas grown for the fresh vegetable market, old plants should be removed as soon as the crop has been picked and should be used as cattle food, turned into silage, or burned. Canning peas are gathered before the larvae are full-fed, and this always results in the death of the larvae and the consequent interruption of the life-cycle. Canning peas should not be grown near vetch or seed peas, and seed should be obtained from moth-free regions. Pods remaining after picking should be cleared away by grazing or ploughing in. Burying immature pods to a depth of $\frac{1}{2}$–$3\frac{1}{2}$ ins. did not cause decomposition in time to arrest development and the mature larvae escaped. The larvae are effectively removed when the peas are passed through the viner, sorting belts and brine solutions, but the difficulty at the cannery is to remove the injured peas. Concentrated brine solution has proved unsatisfactory, and hand sorting on conveyor belts is now resorted to, with partial success. Experiments on peas grown to maturity for drying and for seed showed that 76 per cent. of the larvae escaped before the peas were gathered and of the remainder 50 per cent. were mature. This causes considerable increase in infestation in the following year, and rotation of crops is essential. New fields should be at least $1\frac{1}{2}$ miles from the old, experience in Washington showing that $\frac{1}{4}$ mile [*R.A.E.*, A **20** 408] is quite insufficient. Damaged seed peas must be removed. This can be done to a certain extent by cleaners but must be completed by hand.

The growing of peas, vetch, or sweet peas was prohibited in the most seriously infested area of Skagit County (17,000 acres) in 1935, with a view to reducing the number of moths before re-establishing the industry with a control programme.

Insecticides are not considered suitable for use against pod-boring insects, and several tested in preliminary experiments as ovicides or against the migrating larvae proved ineffective.

Experiments are being conducted with some of the parasites of *Cydia* (*Laspeyresia*) *molesta*, Busck, to see whether they will infest *C. nigricana* also. Of these, *Macrocentrus ancylivorus*, Rohw. [*cf.* **24** 303] and *M. thoracicus*, Nees, have completed their life-cycle on pea moth larvae and may prove useful.

ESSIG (E. O.). **New California Aphididae.**—*Pan-Pacif. Ent.* **12** no. 2 pp. 65–72, 4 figs. San Francisco, Calif., April 1936.

Descriptions are given of the winged and apterous viviparous females of three new Aphids from California, including *Macrosiphum scoliopi* on *Lilium speciosum* var. *rubrum* and a small native liliaceous plant (*Scoliopus bigelovii*), and *Myzus langei* on water-cress [*Nasturtium*].

ESSIG (E. O.). **The Onion Aphid.**—*Pan-Pacif. Ent.* **12** no. 2 p. 72. San Francisco, Calif., April 1936.

The author agrees with Dr. R. Takahashi that *Micromyzus alliumcepa*, Essig [*R.A.E.*, A **24** 247] is identical with *M.* (*Fullawayella*) *formosanus*, Takah. [**10** 408].

GAHAN (A. B.). *Tetrastichus brevistigma*, **new species** (**Hymenoptera : Eulophidae**).—*Proc. ent. Soc. Wash.* **38** no. 4 pp. 76–77. Washington, D.C., May 1936.

Descriptions are given of both sexes of *Tetrastichus brevistigma*, sp. n., which was bred from the pupae of *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.) (elm leaf beetle) in Massachusetts.

MAHEUX (G.). **Sur l'introduction récente en Gaspésie de la pyrale des pois.** *Laspeyresia nigricana* **Stephen.**—*Nat. canad.* **63** no. 3 pp. 73–77. Quebec, March 1936.

The cultivation of peas in the district of Gaspé (Quebec) is threatened by *Cydia* (*Laspeyresia*) *nigricana*, Steph., which was noted for the first time in this area in August 1934.

GOBEIL (A. R.). **Notes sur la biologie d'***Ips perturbatus* **Eichh.**—*Nat. canad.* **63** no. 4 pp. 97–103, 5 figs. Quebec, April 1936.

Ips perturbatus, Eichh., all stages of which are briefly described, is not of primary importance, as it generally attacks white spruce [*Picea glauca*] already killed or weakened by *Dendroctonus piceaperda*, Hopk. In the Gaspé Peninsula, where these observations were made, it was also found in white spruce that had been almost completely defoliated by *Diprion polytomus*, Htg. The adults hibernate in the moss, emerging at the beginning of June and making galleries in the trees. The eggs

deposited in the galleries hatch in about a fortnight, and the larvae feed on the inner bark for about a month, when they pupate. The pupal stage lasts 9–14 days. The adults remain under the bark for 1–2 months and emerge to hibernate. They live for 2 years, dying in the course of the second summer. Natural enemies are of little importance. The Braconid, *Coeloides dendroctoni*, Cushm., which is the most abundant, does not parasitise more than 5 per cent. of the larvae.

Beaulne (J. L.). **Contribution à l'étude des Coléoptères du Canada.**—*Nat. canad.* **63** no. 5 pp. 158–164. Quebec, May 1936.

A list is given of 21 beetles from Canada, with references to the literature. They include the Brenthid *Platysystrophus* (*Eupsalis*) *minutus*, Drury, which bores in recently-felled deciduous forest trees, seriously diminishing the value of the timber, and the Curculionid, *Ithycerus noveboracensis*, Forst., which does considerable damage to fruit trees, both before the buds open and later by feeding on the young stalks.

Ruhmann (M. H.). **Report of Provincial Entomologist.**—*Rep. Dep. Agric. Brit. Columbia* 1935 **30** pp. AA 38–AA 39. Victoria, B.C., 1936.

Brief records are given of some of the pests observed in British Columbia in 1935. The mealybug occurring on fruit trees [*R.A.E.*, A **23** 715] had extended its distribution in the Kootenays. Tests of sprays for its control did not give conclusive results.

Hopping (G. R.) & Leech (H. B.). **Sawfly Biologies. I.** *Neodiprion tsugae* **Middleton.**—*Canad. Ent.* **68** no. 4 pp. 71–79, 20 figs., 3 refs. Orillia, April 1936.

In 1931, an outbreak of *Diprion* (*Neodiprion*) *tsugae*, Middleton, on western hemlock [*Tsuga heterophylla*] over an area of about 40 sq. miles in the Queen Charlotte Islands, British Columbia, killed many of the trees. The infestation had practically disappeared by 1933. Observations in the laboratory and a field cage on the bionomics of this sawfly were carried out at Vancouver in 1932–33. All stages are described. The eggs are laid during late August and the greater part of September at Vancouver, and in late September and early October on the Islands. The number of eggs dissected from females varied from 61 to 103 with an average of 72·5. The eggs are deposited singly in slits in the leaves and were only observed on *Tsuga* ; sometimes 2–5 are found in one leaf. The first larvae hatched on 17th May in 1932 and 20th May in 1933. The young larvae are gregarious and prefer the old needles, which are eaten from the tip to the base. In early June the larvae become less gregarious and feed on both the old and new growth. They were observed to feed only on western hemlock. Those in the field cage were about full-grown by 27th June in 1932 and 10th July in 1933. Cocoons are formed during July and early August at Vancouver and late August and early September in the Islands, and are attached to the lower surfaces of twigs and needles. The first cocoons were observed on 4th July in the field cage, and the time from spinning the cocoons to emergence of the adults was 30–35 days. The dates of emergence of

the adults at Vancouver in 1932 are shown in a table. The first adults emerged on 8th August in the laboratory and on 22nd August in the field. The cocoons in the laboratory had been taken from the field cage between 16th July and 2nd August, and it is probable that if they had been left outside, the dates of emergence in the field and laboratory would have been about the same. Between 8th and 12th September 3 pupal cases containing females were placed on hemlock twigs under cheesecloth bags on a caged tree. By 26th September at least 20 eggs had been deposited. These eggs hatched on 27th May, and the first cocoon was observed on 15th July. From the 5 cocoons recovered 4 males emerged, but the results were insufficient to show whether only males are produced by parthenogenesis.

Parasites reared from the pupal cases were *Delomerista* sp., *Phaeogenes hariolus*, Cress., *P. arcticus*, Cush., *Microcryptus* (*Pezoporus*) sp. and *Olesicampe* sp.

Brown (A. W. A.). **Miscellaneous Physiological Observations on the Laboratory Breeding of Flesh Flies and of *Melanoplus bivitattus* Say.**—*Canad. Ent.* **68** no. 4 pp. 88–91, 6 refs. Orillia, April 1936.

Large numbers of *Melanoplus bivitattus*, Say, have been reared from egg to adult on a diet of whole lettuce heads, although in the course of the work by Hodge on *M. differentialis*, Thomas [*R.A.E.*, A **21** 568], high mortality and an adult life of only 48 hours occurred when diet was restricted to the outer leaves of this plant. Fresh heads were added every two days, and distilled water was constantly supplied. Although mortality was high throughout all stages, most of the adults lived long, and before the experiment was terminated, some had survived for 47 days. Pairing was frequent and oviposition sporadic.

Bird (R. D.) & Allen (W. R.). **An Insect injuring Sunflowers in Manitoba.**—*Canad. Ent.* **68** no. 4 pp. 93–94. Orillia, April 1936.

Damage to the heads of sunflowers [*Helianthus*] by *Homoeosoma electellum*, Hulst, was observed in 1935 in certain localities in Manitoba, where the seeds are used for human consumption. This Pyralid has not previously been recorded in Manitoba. It was reported that the leaves and stems also were attacked. The larvae are usually found on the disks under débris composed of dead florets, etc., but also tunnel into the disks or seeds, on which they feed. They may sometimes be found at the edge of the disk under the bracts of the involucre. The heads turned black and in some cases became folded upwards into a V-shape. Only 4 larval instars were observed in the laboratory. The third and fourth instars and the prepupal and pupal stages occupied 3–6, 7–16, 3–6 and 16–24 days respectively. Adults emerged from 3rd to 29th September in the laboratory and oviposited on sunflower heads. The average length of the life-cycle was one month.

Gorham (R. P.). **The Strawberry Weevil.**—3 pp., multigraph, 3 figs. Fredericton, N.B., Domin. ent. Lab., April 1936.

The strawberry weevil [*Anthonomus signatus*, Say] is widely distributed in Canada and sometimes causes serious reduction of the crop of strawberries by destroying the flower buds. It also infests the buds

of raspberries and blackberries. It has one generation a year, the adults emerging in late summer and hibernating among débris in the field, in adjacent woodland or along fence-rows. The eggs are laid during a period of about two weeks preceding full bloom. The female oviposits in a bud and then cuts the stem just below the pedicle, so that the bud hangs downward and eventually falls to the ground. The larva feeds on the stamens in the partly-developed bud.

New strawberry fields should be established in open situations, away from woodlands and from existing plantations, and weeds on the surrounding land should be burnt off [*cf. R.A.E.*, A **18** 378]. Old plantations should be ploughed immediately after harvest (in July if possible) as this destroys many of the developing weevils. Some growers plant as the main crop pistillate varieties of strawberry, on which the weevils do not oviposit, interspersing about 1 row in 6 of a staminate variety to ensure pollination. Records show that vigorous plants produce more flower buds than small ones and that only about half of the buds develop commercial fruits, so that the loss of a small number of buds is much more serious in a field of small plants than in one where the plants are vigorous. Accordingly the importance of the damage is reduced by renewing the plantation frequently and keeping the plants strong. In the case of raspberries, a certain control can be effected by jarring the beetles from the bushes into a receptacle containing water and kerosene.

A dust of lead arsenate and sulphur [**11** 394; **15** 143] has, for some years, given the best artificial control on strawberries, though it has not always proved effective under conditions in the Maritime Provinces. For raspberries talc should be used instead of sulphur, which tends to scorch the foliage. It is now thought inadvisable, however, to apply insecticides containing arsenic or lead on such fruits as raspberries and strawberries, and experiments with substitutes are being conducted. If arsenicals are used, they must not be applied after any flowers are open.

HAMBLETON (E. J.). **Notas sobre Pseudococcinae de importancia economica no Brasil com a descripção de quatro especies novas.** [Notes on Pseudococcinae of economic Importance in Brazil with Descriptions of four new Species.]—*Arch. Inst. biol.* **6** pp. 105–120, 15 figs., 2 pls. S. Paulo, 1935. (With a Summary in English.) [Recd. June 1936.]

The new species described are *Pseudococcus magnoliae* from *Magnolia grandiflora*, *P. inamabilis* from *Cupressus glauca*, *P. tibouchinae* from *Tibouchina mutabilis*, and *P. sociabilis* from *Erythrina reticulata* and ivy (*Hedera helix*). The others recorded are *P. comstocki*, Kuw., which, in the States of São Paulo and Rio de Janeiro, is the common mealybug on *Citrus*; *P. citri*, Risso, which is rare on *Citrus*; *P. adonidum*, L. (*longispinus*, Targ.) on *Citrus*, mango, etc.; *P. maritimus*, Ehrh., on potato, etc.; *P. boninsis*, Kuw., on sugar-cane; *P. grandis*, Hemp., on guava, etc.; *P. brevipes*, Ckll., on pineapple, etc.; *P. cryptus*, Hemp., on coffee and *Citrus*; *P. nipae*, Mask., on *Achras sapota*, etc.; *Phenacoccus gossypii*, Tns. & Ckll., on tomato, cassava, wild tobacco, etc.; *Trionymus minutus*, Hemp., on *Citrus*; *T. sacchari*, Ckll., on sugar-cane; and *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., on mango, etc.

Lepage (H. S.). **Uma especie nova do genero** *Chionaspis* **(Homoptera-Coccoidea).**—*Arch. Inst. biol.* **6** pp. 167–170, 13 figs. S. Paulo, 1935. (With a Summary in English.) [Recd. June 1936.]

Chionaspis hempeli, sp. n., is described from *Notrodorea nigra* and other wild plants in Brazil. It was much attacked by a fungus, *Sphaerostilbe* sp., and some individuals were parasitised by Hymenoptera.

de Toledo Piza Junior (S.) & Pinto da Fonseca (J.). *Heterospilus coffeicola* **Schmied. Parasita da Broca do Café,** *Stephanoderes hampei* **(Ferr.).**—*Arch. Inst. biol.* **6** pp. 179–199, 12 figs., 1 pl., 3 refs. S. Paulo, 1935. (With a Summary in English.) [Recd. June 1936.]

In 1934 the authors studied in Uganda the parasitisation of the coffee berry borer, *Stephanoderes hampei*, Ferr., by *Heterospilus coffeicola*, Schmied., and found the action of this Braconid to be complementary to that of the Bethylid, *Prorops nasuta*, Wtstn., without interfering with it. Parasitism by *Heterospilus* occurred at the beginning of the infestation of the coffee seed by *Stephanoderes*, at the time of oviposition, while *Prorops* visited the seeds when they already contained host larvae. All stages of *H. coffeicola* are described. It did not reproduce in the laboratory, possibly because the female may require a free flight of some extent before oviposition, and to study its biology large quantities of berries infested by the borer had to be collected. The female lays a single egg in a seed in which *Stephanoderes* has recently oviposited, so that host eggs are available when the parasite larva hatches. The egg stage appeared to last about 6 days. In the laboratory a larva could destroy more than 10 host eggs in a day. In four instances both larvae and eggs of *Stephanoderes* were found together with a larva of *H. coffeicola*, and in experiments in which no eggs were available, the parasite sucked the borer larvae, being able to kill 3 in a day. It was also able to suck and kill the pupae. After 18–20 days, during which it consumed 30–40 borer eggs, the larva killed the adult female borer, spun a cocoon and pupated. Larvae were able to survive starvation for 10 days, but those fed on only one egg daily required more than 30 days to develop and spun poor cocoons, which they usually failed to complete. Larvae fed on one egg every other day failed to develop. These observations indicated that in nature the female of *S. hampei* oviposits more frequently than in the laboratory, where it has been observed to lay single eggs at intervals of 2 or more days and then to cease oviposition for periods of 4–24 days.

H. coffeicola can develop only in regions where coffee berries are produced uninterruptedly throughout the year, and for its establishment in Brazil permanent foci of the borer would have to be maintained in the open. Its introduction is therefore considered inadvisable. In any case neither *H. coffeicola* nor *P. nasuta* appeared to control *Stephanoderes* at Kampala.

Ronna (A.). **Observações biologicas sobre dois dipteros parasitas de** *Apis mellifica* **L. (Dipt. Phoridae, Sarcophagidae).** [Biological Observations on two Parasites of *A. mellifica*.]—*Rev. Ent.* **6** fasc. 1 pp. 1–9, 4 figs., 4 refs. Rio de Janeiro, 30th April 1936.

Serious mortality in adult honey-bees at the Experiment Station at Deodoro, Brazil, was traced to parasitism by the larvae of the Phorid,

Melaloncha ronnai, Borgm. [*R.A.E.*, A **24** 408] and, to a less degree, by those of *Sarcophaga surrubea*, Wulp. The Phorid appears to be a true endoparasite ; it pupates in the bee, and probably oviposits in it. The pupa is described. All dead and dying bees should be burned, and the ground of the apiary should be watered with a strong insecticide.

CARTER (W.). **Insects and Plant Diseases.**—*Proc. Hawaii. ent. Soc.* **9** no. 2 pp. 159–170, 2 figs., 14 refs. Honolulu, April 1936.

In this presidential address the author exemplifies some general problems of the relations of insects to plant diseases by instances occurring under local conditions in Hawaii.

The simplest relation between an insect and a pathological condition of the plant is shown by the way in which infestation by a large colony of *Pseudococcus brevipes*, Ckll., leads to cracking between the fruit eyes of a pineapple, followed by the entrance of souring beetles [*R.A.E.*, A **21** 133]. A more complicated case is found in leafhopper burn, which, in Hawaii, is caused by *Empoasca solana*, DeLong, apparently through a toxic secretion producing only local symptoms. This Jassid secretes diastase (which is associated with yeasts in the intestinal tract) and invertase [*cf.* **23** 496]. It produces similar symptoms in watermelons and castor [*Ricinus communis*], and less pronounced ones in potatoes, but in *Amarantus* causes only a stippling of chlorotic spots. Further studies on secretions are desirable to find the reasons for such variations in effect, and whether they are due to the plants' reactions to the specific secretion of the insect or to variations in the nature of the secretions analogous to those in the plant saps from which they are synthesised. The complex effects of the food-plant and internal symbiosis of an insect on its toxic secretions have been shown by studies on the relation of *P. brevipes* to green spotting of pineapple [**23** 166, etc.], and problems of mass action arise in connection with pineapple wilt caused by the same mealybug. [*Cf.* **21** 64 ; **23** 641, etc.]

Yellow spot, the only virus disease of pineapple known in Hawaii, does not occur elsewhere. It is transmitted by *Thrips tabaci*, Lind., but is only serious intermittently. The pineapple, which is not a normal food-plant of this thrips, may be free from infection or only slightly diseased in a field where weeds are severely infested and diseased. Since this thrips is an introduced insect, two hypotheses are put forward for the origin of the virus ; first, that the virus was introduced with the thrips, but has remained unrecognised at the place of origin, and secondly, that on introduction the thrips acquired the virus from one of the many susceptible weeds and communicated it to *Emilia sagittata*, which is at present its principal known reservoir and a favoured food-plant of the insect [**20** 639]. Both these hypotheses lead to the conclusion that a new economic virus may arise as a result of contact between potential insect vectors and new plant sequences. A similar case is that of mosaic of *Commelina nudiflora*, which has been transmitted experimentally to pineapple by mechanical means, and later by using 3 species of Aphids. The disease in pineapple is severe and frequently lethal, but it is not yet known to occur in the field. Thus, with an efficient vector a virus established in weeds may become of economic importance by transference to an economic plant, and the increasing number of new viruses being described may be due in part to the wider distribution of insect vectors and virus host-plants through

the development of world agriculture and transport. The discussion assumes that viruses cannot be created, but should further study confirm the protein theory of all or some viruses, then the creation of viruses or chemical mutants of existing ones will only be limited by the factors ordering the arrangement of protein molecules. In such a case the elaboration of protein virus molecules may well be conditioned by the factors of insect nutrition and secretions, and the so-called incubation periods of viruses in insects may be the periods necessary for such elaboration.

COMPERE (H.). **A new Genus and Species of Encyrtidae parasitic in the Pineapple Mealybug,** *Pseudococcus brevipes* **(Ckll.).**—*Proc. Hawaii. ent. Soc.* **9** no. 2 pp. 171–174, 1 fig. Honolulu, April 1936.

Both sexes of *Hambletonia pseudococcina*, gen. et sp. n., are described from *Pseudococcus brevipes*, Ckll., on pineapple in Brazil. Each infested mealybug contained 1–4 parasites.

DOZIER (H. L.). **Several undescribed Mymarid Egg-parasites of the Genus** *Anagrus* **Haliday.**—*Proc. Hawaii. ent. Soc.* **9** no. 2 pp. 175–178. Honolulu, April, 1936.

Two new species of *Anagrus* are described, and brief notes are given on others, including *Anagrus frequens*, Perk., reared from eggs of *Peregrinus maidis*, Ashm., on maize, and *Anagrus* sp. from eggs of *Empoasca solana*, DeLong, both in Hawaii.

SWEZEY (O. H.). **Fruit-eating and Seed-eating Insects in Hawaii.**—*Proc. Hawaii. ent. Soc.* **9** no. 2 pp. 196–202. Honolulu, April 1936.

A list is given of over 60 species of native and introduced insects that feed on fruits and seeds in Hawaii. They are arranged by families, about half being Lepidoptera.

VAN ZWALUWENBERG (R. H.). **A new Species of** *Pyrophorus* **(Coleoptera, Fam. Elateridae) from Guatemala, recently introduced into Hawaii.**—*Proc. Hawaii. ent. Soc.* **9** no. 2 pp. 231–234, 1 fig., 2 refs. Honolulu, April 1936.

Both sexes of *Pyrophorus bellamyi*, sp. n., are described from adults reared from larvae collected on the Pacific slope of Guatemala, at an altitude of about 1,100 ft. No adults were observed in flight, and only one was obtained otherwise than by rearing . This Elaterid is the species of which 446 larvae were introduced into Hawaii during 1934 and 1935 against *Anomala orientalis*, Waterh. [*cf. R.A.E.*, A **24** 379, etc.]. It was reared in the laboratory, and about 150 adults and 1,000 larvae were released on Oahu.

[KIRYUKHIN (G. A.).] **Кирюхин (Г. А.). Tent Fumigation of Citrus Trees in Groves.** [*In Russian.*]—63 pp., 18 figs., 1 graph, 12 refs. Sukhum, Abkhazsk. Inspektz. Karant., 1936. Price 1 *rub.* 50 *kop.*

This booklet opens with a summary of the history of fumigation of *Citrus* trees with hydrocyanic acid gas for the control of Coccids and

gives information on the equipment required for tent fumigation, the technique of the work, using sodium cyanide and dilute sulphuric acid, and the effect of the gas on the trees and on insects. From experience in Transcaucasia, tables are given showing that fumigation is economically superior to the use of oil sprays, if the increased yield of fruit is taken into account.

[Gogiberidze (A. A.).] **Гогиберидзе (А. А.). Noxious Coccids of the humid Subtropics of the U.S.S.R.** [*In Russian.*]—9 pls., 1 p. text. Sukhum, Abkhazsk. Inspektz. Karant., 1936.

This brochure consists of plates illustrating 54 species of Coccids found in Transcaucasia, arranged by food-plants.

[Zonova (E. V.).] **Зонова (Е. В.). Die Lärchenfliege (*Chortophila laricola* Karl) als Schädling der Lärchensamen.** [The Larch Seed Fly, *Phorbia laricola*, as a Pest of Larch Seeds.] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 206–220, 17 figs. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

Larch seeds are of value in Siberia for export, but are severely damaged by insect pests. Investigations in the summer of 1930 in a larch forest on mountain slopes on the south-eastern shore of lake Baikal showed that the Anthomyiid, *Phorbia* (*Chortophila*) *laricicola*, Karl, which had previously been recorded only from Austria [*R.A.E.*, A **18** 266], was chiefly responsible for the heavy losses in the seed crop. The species of larch concerned were *Larix sibirica* and *L. dahurica*, the trees varying in age from 30 to 175 years and growing together with other conifers in the proportion of 7 : 3. All stages of *P. laricicola* are described in detail. The adults were ovipositing in the forest from about mid-June to 20th July. In the insectary, pairing took place 2–3 days after emergence, and the females laid 2–3 eggs at a time. The eggs were laid under the scales of young larch cones, 1–3 to a cone, and hatched in 9–14 days in the open. The larvae fed on the seeds inside the cone for 39–47 days and then entered the ground litter, usually to a depth of about an inch. There they hibernated in their puparia, pupating in the spring of the following year. One larvae injures up to 70 per cent. of the seeds in a cone and consumes 16–56 seeds. If 2 or 3 larvae occur in a cone, all the seeds are more or less damaged.

Other larvae found infesting the larch cones were the Pyralid, *Dioryctria abietella*, Schiff., which fed on the scales, Tortricids, including *Cydia* (*Laspeyresia*) *coniferana*, Ratz., and an undescribed species of *Rhyacionia* (*Evetria*) allied to *R. resinella*, L., and Cecidomyiids which occurred under the scales near the seeds and rendered the latter dark brown, hard and dry, so that they were avoided by *Phorbia* and the Lepidoptera. Observations on the distribution of infestation showed that *P. laricicola* chiefly occurred on solitary larches and those in mixed stands, and preferred the upper parts of the crown and trees on the top of the mountains and on the southern slopes. The Cecidomyiid larvae mainly occurred on larches in mixed stands and on the northern slopes of the mountains ; and the Lepidoptera were not affected by any particular factor.

As a result of injury by all these insects, the seed crop of larch dropped from 3,520 lb. in 1910 to 420 lb. in 1929, when 92 per cent. of the cones were injured. Some of the cones were infested by more than one pest,

82·42 per cent. being attacked by *P. laricicola*, 8·07 per cent. by Cecidomyiids and 5·46 per cent. by the Lepidoptera.

Of the overwintering puparia of *P. laricicola*, 28 per cent. were found to be parasitised by the Ichneumonid, *Asyncrita rufipes*, Först., 1·34 per cent. by the Braconid, *Phaenocarpa seitneri*, Fahr., and 0·66 per cent. by the Cynipid, *Seitneria austriaca*, Tavares. To reduce the infestation, all the rubbish that has accumulated in the forest for years should be removed, as it provides favourable conditions for hibernation. In future, all branches removed in harvesting the seeds should be piled into heaps and burned.

[Rimskiĭ-Korsakov (M. N.).] **Римский-Корсаков (М. Н). Die Parasiten von** *Chortophila laricicola* **Karl.** [*In Russian.*]—*Rev. Ent. USSR* **25** no. 3–4 pp. 221–222, 4 refs. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

Brief notes are given on the parasites, *Seitneria austriaca*, Tavares, *Phaenocarpa seitneri*, Fahr., and *Asyncrita rufipes*, Först., obtained from the puparia of the larch seed fly, *Phorbia* (*Chortophila*) *laricicola*, Karl. [see preceding paper]. All three species have previously been recorded from Central Europe [*R.A.E.*, A **18** 266], and their occurrence on the shores of Lake Baikal is of zoogeographical interest.

[Ésterberg (L. K.).] **Эстерберг (Л. К.). Zur Kenntnis der Schnellkäferfauna (Coleoptera, Elateridae) des Gebiets von Gorjkij (früher Nizhniĭ-Novgorod).** [On the Elaterid Fauna of the Gor'kiĭ Region (formerly Nizhniĭ-Novgorod).] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 223–228, 3 refs. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

As a result of examinations of collections of Elaterid beetles made in 1909–18 and 1923–30, a list is given of 53 species that occur in the former Department of Nizhniĭ-Novgorod and the adjoining Departments, with notes in each case on the date and place of capture and the number of individuals taken. A table shows the numbers of larvae of a few species of Elaterids and Tenebrionids taken in 1929 and 1930 in the soil in cultivated fields, the crops attacked and the locality and date of capture.

[Gussakovskiĭ (V. V.).] **Гуссаковский (В. В.). Eine neue Art der Gattung** *Cephalonomia* **Westw. (Hymenoptera, Bethylidae), Parasit von** *Silvanus surinamensis* **L.** [A New Species of the Genus *Cephalonomia* Westw. (Hymenoptera, Bethylidae), Parasite of *Oryzaephilus surinamensis*.] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 229–231, 5 figs. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

Descriptions are given in Latin of both sexes of the Bethylid, *Cephalonomia destructrix*, sp. n., reared from larvae ectoparasitic on those of the grain beetle, *Oryzaephilus* (*Silvanus*) *surinamensis*, L., in Tashkent. It is suggested that this Bethylid might be used for the biological control of the beetle, as it was very easily reared in the laboratory and rapidly increased in numbers. The adults fed on the host larvae as well as paralysing them for oviposition.

[Znoĭko (D. V.).] **Знойко (Д. В.). Die Larven des grossen Getreidelaufkäfers** (*Zabrus blapoides* **Creutz.**) **und des Hirselaufkäfers** (*Harpalus calceatus* **Duft.**) **(Coleoptera, Carabidae).** [The Larvae of the large Cereal Carabid (*Z. blapoides*) and the Millet Carabid (*H. calceatus*).] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 232–238, 5 figs., 1 ref. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

Detailed descriptions are given of the larvae of the Carabids, *Zabrus blapoides*, Creutz., and *Harpalus calceatus*, Duft., which are common pests in the Russian Union. The larvae of *Z. blapoides* and *Z. tenebrioides*, Goeze, both attack autumn-sown wheat in the Ukraine, injuring the plants at the base, but as those of *Z. blapoides* are larger, they also destroy the whole of the young plants above ground. In 1927–29 the latter species was the more abundant of the two near Odessa, the larvae pupating about the end of May. In the insectary, one individual reached the adult stage in August, but it is probable that the adults hibernate before ovipositing, so that the life-cycle requires two years. Keys are given to the larval instars of *Z. blapoides* and to the mature larvae of this species and *Z. tenebrioides*.

Larvae of *H. calceatus* were obtained from the Region of the Volga Germans, where they feed on the grain in the ears of cultivated millet and *Setaria viridis*.

[Ermolaev (V. N.).] **Ермолаев (В. Н.). Beitrag zur Kenntnis der Morphologie und Biologie des Lärchenspanners** (*Semiothisa pumila* **Kuzn.**). [Contribution to the Knowledge of the Morphology and Biology of the Larch Geometrid (*S. pumila* Kuzn.).] [*In Russian.*] —*Rev. ent. URSS* **25** no. 3–4 pp. 239–253, 6 figs., 7 refs. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

Recent investigations have shown that *Semiothisa pumila*, Kuzn., is widely distributed in the eastern part of Asiatic Russia, the district of Krasnoyarsk (central Siberia) being the north-western limit of its distribution. Larch (*Larix sibirica*) appears to be the only normal foodplant, though young pines (*Pinus sylvestris*) have occasionally been infested, probably owing to lack of food. An outbreak of this Geometrid began unexpectedly in the district of Krasnoyarsk in May 1927 and reached its peak in 1929, when forests over an area of 3,700–5,000 acres were severely injured. Following a decrease of infestation in 1930, all traces of the pest had disappeared by the spring of 1932.

The immature stages of this moth are described in great detail, and an account is given of its bionomics, based on observations by other workers, mostly unpublished. Hibernation occurs in the pupal stage, and lasts over 9 months. In 1928, the adults began to emerge in mid-June, became abundant about 12 days later at a temperature of 25°C. [77°F.], and disappeared in the second half of July. In the insectary, the oviposition period lasted about a month from 24th June, eggs being laid 30–40 hours after emergence. In the forest, the eggs were found at the end of July on the bark of thin twigs of larch. They are apparently usually deposited at a considerable height, which accounts for the fact that young trees are only slightly injured. A female lays 85–90 eggs in 2½ days. The larvae hatch in 9–18 days and feed for about 5 weeks. If deprived of food, they died in 10 days. They can evidently migrate, as fully grown individuals were found in numbers on stumps nearly 100 ft. from the infested trees. Mass pupation occurred about

mid-September just below the surface of the soil or in the moss on the ground. As many as 36 pupae per sq. yd. were present under larch trees in 1928–29.

Large numbers of larvae died in the autumn of 1928 from starvation on defoliated trees ; in the spring of 1929 up to 25 per cent. of overwintered pupae had been killed by Ichneumonids and Tachinids, and 15 per cent. were attacked by a fungus that had only infested 2 per cent. before hibernation.

[Lugovoĭ (A.).] **Луговой (А.). Ueber Maikäferverwertung in der Seifensiederei.** [On the Utilisation of Cockchafers in Soap Industry.] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 305–307, 1 fig. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

A brief account is given of a successful experiment carried out in the course of which soaps were prepared from adults of the cockchafer [*Melolontha hippocastani*, F.], collected in a pine forest in the Department of Samara. The results are also given of chemical analysis of fresh and dry beetles.

[Zimin (L. S.).] **Зимин (Л. С.). Zur Synonymie und geographischen Verbreitung von *Echinomyia magna* Giglio-Tos (Diptera, Tachinidae) im paläarktischen Reich.** [Contribution to the Synonymy and geographical Distribution of *E. magna* (Diptera, Tachinidae) in the Palaearctic Region.] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 308–313, 1 fig., 10 refs. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

On the basis of a comparison of the descriptions and of specimens from Europe and Asia, the author concludes that *Echinomyia autumnalis*, Giglio-Tos, *E. fulvicornis*, Strobl, and *E. dendrolimi*, Mats., are synonyms of *E. magna*, Giglio-Tos, which he redescribes in detail. This Tachinid is a parasite of *Dendrolimus sibiricus*, Tshtv., in Siberia, but as its distribution extends much further west, it probably parasitises other large Lepidoptera in Europe.

[Fabri (I. A.).] **Фабри (И. А.). Beobachtungen und Versuche über das Geschlechtsleben von *Saturnia pyri* Schiff. (Lepidoptera).** [Observations on and Experiments in the sexual Life of *S. pyri*.] [*In Russian.*]—*Rev. Ent. URSS* **25** no. 3–4 pp. 314–319. Leningrad, 1935. (With a Summary in German.) [Recd. May 1936.]

An account is given of experiments carried out near Poltava in May in 1927–32, in which newly emerged females of *Saturnia pyri*, Schiff., were placed in cages to attract the males. The larvae of this moth attacked the leaves of plums and cherries, and to a less extent pears, apples and ash. Of marked males released at various distances from the cages, some flew for 5 miles and covered this distance in 45 minutes, though the line of flight was obstructed by hills, a forest, a stretch of sand and tall trees. Males deprived of their antennae did not come to the females, but those with only half of each antenna removed were attracted. The attraction given off by the female is probably particularly effective in the evening.

The author made similar experiments in 1932 with *Porthetria* (*Lymantria*) *dispar*, L., when by using a single unfertilised female, over 200 males were caught in a day [*cf.* **23** 668, etc.].

Lewin (C. J.). **Northern Rhodesia Department of Agriculture. Annual Report for the Year 1935.**—23 pp. Lusaka, 1936.

Observations at the Mazabuka Station are recorded (pp. 8–10), on the relationship of populations of *Dysdercus* to wild food-plants and cotton [*cf. R.A.E.*, A **22** 679 ; **24** 282, etc.]. It was confirmed that cotton forms a link in the sequence of food-plants of *D. superstitiosus*, F., and that the incidence of *D. fasciatus*, Sign., is directly proportionate to the general condition of *Thespesia rogersi*, its only wild food-plant. *D. superstitiosus* was most injurious in country of the *Acacia*-savannah type, owing to the absence of food-plants other than cotton between February and late March. It was found in October and November on *Triumfetta* sp., this being the first record of its activities during the dry season.

A brief account is given (p. 11) of the life-history of *Anthores leuconotus*, Pasc. (white coffee borer), which has now been worked out in some detail at Abercorn. It differs from that already noticed [**23** 533] in only a few particulars. Adults emerge from October to January, and egg laying continues until death, which may not take place till the middle of March. The eggs are laid deeply in the bark, occasionally as high as 18 inches above the ground, and vigorous rubbing is usually insufficient to dislodge or crush them. The normal incubation period is 20–30 days, and the larval feeding period lasts 6–10 weeks above ground, and 18 months in the roots. Pupation occurs early in October. It is recommended to extend hand-picking of adults until February. Dead trees should be uprooted and the larvae destroyed.

Harukawa (C.), Takato (R.) & Kumashiro (S.). **Studies on the Rice-borer. iv, v. On the prolonged Emergence Period of the Moth in the Spring. ii, iii.**—*Ber. Ōhara Inst. landw. Forsch* **7** no. 2 pp. 239–271, 19 refs. Kurashiki, 1936.

In a previous paper it was pointed out that the temperature of the hibernacula might be one of the factors affecting the time of emergence of the rice-borer [*Chilo simplex*, Btlr.] in Japan [*R.A.E.*, A **20** 329].

The first of these two papers records investigations on the effect of contact water on the time of initiation of development of the hibernating larvae and on the speed of their development. The work was done in the insectary at varying temperatures and in incubators at different constant temperatures.

The following is taken from the summary : When the hibernating place of the borer is moistened moderately with contact water, pupation occurs somewhat earlier and the pupal period is slightly shortened. The effect, however, is insufficient to account for the prolonged period of emergence of the moths. The breaking up of hibernation cannot be explained by the effect of temperature and contact water alone, though these factors may be admitted to have considerable influence. While excessive moisture slightly reduces the percentage of moths that emerge and also slightly retards the date of emergence, dryness also retards the date of emergence and diminishes the percentage of transforming larvae and the rate of emergence of Hymenopterous parasites.

The second paper gives the results of experiments on the effect of food and degree of growth on the time of pupation and emergence.

In northern Japan most of the larvae of the first generation overwinter. When another generation is produced, the larvae are unable to become

full-grown before the advent of winter and die in the hibernation period. No studies appear to have been made with hibernating immature larvae in a milder climate, such as prevails in the southern part of the Okayama Prefecture. The authors supposed that even in Kurashiki there might be some second generation larvae, not fully grown though past the last moult, and that the time of emergence of such larvae might differ according to whether they could find food freely in spring or not. Assuming that the degree of development of hibernating larvae could be distinguished by body size, experiments were made to see if the time of adult emergence differed according to larval size and whether larval feeding during hibernation affected it. It appeared, however, that there was no connection between larval size and degree of larval development. Most large hibernating larvae were females and most small ones males. The percentage of parasitism was markedly higher among the small larvae. Though the time of adult emergence in spring was slightly earlier when food had been supplied to the hibernating larvae, this appeared to be due to the action of the water in the fresh food supplied (fresh culms of the rice or wheat or sometimes sugar-cane). Though the larvae readily bored into such material, it was not ascertained whether they really utilised it as food.

HART (P. C.). **Over een biologische bestrijding van den witten topboorder in het suikerriet.** [On biological Control of the White Tipborer of Sugar-cane.]—*Hand. 7 Ned.-Ind. natuurw. Congr.* pp. 415–423. Batavia, 1936.

Hazelhoff indicated the possibility of using indigenous parasites for controlling pests in the Netherlands Indies [*R.A.E.*, A **17** 423]. In considering the question whether the conditions requisite for the success of this method apply in the case of *Scirpophaga intacta*, the chief pest of sugar-cane, the author discusses the special reasons that make it effective when *Encarsia flavoscutellum*, Zehnt., is used against the white sugar-cane woolly aphis, *Oregma lanigera*, Zehnt. [**17** 234]. Attempts to make use of the egg-parasite, *Phanurus beneficiens*, Zehnt., which is the chief parasite of *Scirpophaga* [**21** 677], have failed, and its liberation in the fields from breeding-cages is of doubtful value.

EGGERS (H.). **Neue Borkenkäfer (Scolytidae, Col.) aus Indien.**—*Ann. Mag. nat. Hist.* (10) **17** no. 102 pp. 626–636. London, June 1936.

The new species described include *Crypturgus beesoni* from *Cedrus deodara* and *Pinus longifolia*, *Xyleborus conidens* from coffee, and *Thamnurgides indicus* from the fruits of several plants including coffee in India, *T. cinnamomi* from seeds of cinnamon (*Cinnamomum zeylanicum*) in Ceylon, and *Webbia camphorae* from wood of camphor [*Cinnamomum camphora*] in Malaya.

BARANOV (N.). **Eine neue Calliphorine-Art (Dipt.), die Termiten angreift.** [A new Calliphorine that attacks Termites.]—*Ann. Mag. nat. Hist.* (10) **17** no. 102 pp. 646–651, 2 figs. London, June 1936.

A description is given of both sexes of *Termitoloemus marshalli*, gen. et sp. n., which is stated to be predacious on worker termites in India.

Miles (H. W.) & Cohen (M.). **The Chrysanthemum Leaf Miner and its Control.**—*J. Minist. Agric.* **43** no. 3 pp. 256–261, 2 pls., 1 fig. London, June 1936.

In recent years, *Phytomyza atricornis*, Mg., has caused serious damage to chrysanthemums and cinerarias in England, and in 1935 it was unusually abundant all over the British Isles. Investigations on it were begun at Manchester in that year, and the results so far obtained are summarised.

All stages are briefly described. The flies are found on the undersides of the leaves of rooted plants and cuttings. The females pierce the leaf with the ovipositor, and both sexes feed on the sap at the incisions. A female is capable of laying 50–100 eggs. Oviposition begins soon after emergence ; 2 or 3 eggs are usually found in one leaf, inserted deeply into the underside. At an average temperature of 67°F., the eggs hatch in 4 days. The larvae mine in the leaves, moult twice and pupate in their mines after 10–11 days. Two mines may completely destroy a leaf. At 67°F. the pupal period lasts 9–13 days. Females kept with food-plants live as long as 17 days. There are probably 6 or more generations in a year, and breeding also occurs on some 70 species of weeds, chiefly of the family Compositae. The larvae are attacked by Braconid endoparasites, but pupate before they are destroyed.

Damage is most serious during the propagation season, when 90 per cent. of the cuttings may be affected. Attacks often cease when rooted cuttings are placed in frames, but the plants soon attract flies that have developed on weeds, and infestation may not decline until late August. It is liable to begin again when the plants are brought under glass, in time to cause noticeable injury to very late flowering varieties, and then reaches its height when cuttings are being taken for the following season.

The adult flies can be killed by light fumigations with nicotine or hydrocyanic acid gas, or by the use of nicotine dust. In the spring of 1935, adults, eggs and early stage larvae were destroyed on cuttings sprayed with $\frac{3}{4}$ oz. nicotine and $\frac{1}{2}$ lb. soft soap in 10 gals. water, but puparia were unaffected. Applications of the spray at intervals of 10 days reduced the injury and eventually eradicated the flies. In the early summer, experiments were carried out, in the open, with dusts and sprays applied every 10 days to cover both surfaces of the leaves. Naphthalene-silica dust was ineffective and caused extensive callouses. Sulphur dust had some repellent effect, and nicotine dust gave good control, acting both as a repellent and killing agent, but the best results were obtained from the use of a proprietary nicotine spray, one made of 1 oz. nicotine in 20 gals. water with a suitable spreader being almost as good.

To obtain maximum freedom from infestation, cuttings should be dipped in dilute nicotine solution before they are struck and subsequently sprayed with nicotine every 10 days, both in the boxes and when out of doors.

Joesssel (P. H.) & Suau (J.). **Produits mouillants ou adhésifs dans les traitements mixtes contre le carpocapse et la tavelure.**—*Ann. Épiph. Phytogén.* N.S. 2 fasc. 1 pp. 31–49, 12 refs. Paris, 1936.

In experiments near Avignon in 1935 various adhesives and spreaders were tested in sprays against the codling moth [*Cydia pomonella*, L.] on

pears. The insecticides were 6 lb. lead arsenate or 10 lb. cryolite in 100 gals. Bordeaux mixture (10 : 10 : 100). The substances tested comprised calcium caseinate (1 lb. casein and 1 lb. quick-lime), amyl alcohol (½ gal.), colloidal resin (1 gal. commercial product containing 5 lb.), ½ gal. of a product containing 30 per cent. bile salts, and 2 sulphonated terpene alcohols (1 lb. of an 80 and a 90 per cent. commercial product respectively), in 100 gals. spray. All these were used with lead arsenate, and all except the 90 per cent. sulphonated terpene alcohol with cryolite. Exact analyses are given of the lead arsenate and cryolite. Each substance was tested on two trees with lead arsenate, and on one with cryolite. Two trees were left unsprayed, and others were treated with the insecticides without the addition of a spreader. A calyx and 3 cover sprays were applied, the last on 11th-13th June, and each tree was sprayed thoroughly.

There was little difference between the control on trees sprayed with lead arsenate with and without the spreader, while the difference between two trees receiving the same treatment was perceptible. This may have been due to the light infestation compared to 1934 [*R.A.E.*, A **23** 716] and to the fact that Bordeaux mixture alone spreads relatively easily on the early variety of pears that was used. The best of the spreaders were sulphonated terpene alcohols (90 and 80 per cent.) and colloidal resin, which gave 96·8–95·6, 95·4–93·5, and 96·7–93·8 per cent. uninfested fruit, lead arsenate without a spreader giving 91·5–94·0 per cent. On the unsprayed trees, 52·2–64·3 per cent. of the fruit was uninfested. Results with cryolite were less satisfactory than with lead arsenate, probably owing to its combination with a spray containing lime. The percentages of uninfested fruits were 87 for cryolite without a spreader, 92·4 with amyl alcohol, 91·5 with bile salts, 89·9 with sulphonated terpene alcohol, 85·4 with resin, and 81·6 with casein. Control with cryolite did not appear to depend on the quantity of fluorine on the fruit, as measured by analysis at harvest.

Raucourt (M.) & Trouvelot (B.). **Les principes constituants de la pomme de terre et le doryphore. Réactions d'ordre sensitif chez la larve.**—*Ann. Épiph. Phytogén.* N.S. 2 fasc. 1 pp. 51–98, 6 refs, 11 figs. Paris, 1936.

Previous observations in France on the behaviour and development of *Leptinotarsa decemlineata*, Say, on its food-plants have shown that the larvae and adults react differently and that the reactions may be divided into those connected with the senses of the insect, which determine whether it feeds or not, and those connected with the effect of the plant on it, which determine whether it is nourished or poisoned [*cf. R.A.E.*, A **21** 495]. The investigations discussed in the present paper deal solely with the sense reactions of the larvae, particularly in connection with potato.

Preliminary experiments in the laboratory and the field showed that the sense of taste is the most important in determining the degree of attack on a plant. From the results was evolved the hypothesis that there may exist in a given plant substances which, when introduced into the mouths of insects, determine their attitude towards it ; these are called " active principles " if they induce attack and " repellent principles " if they induce abandonment. In the case of *L. decemlineata* " active principles " appear to occur only in solanaceous plants. It is suggested that they are superimposed on nutritive material existing in all plants like a condiment on insipid food.

The main experiments concerned the search for the active principles in the leaves of solanaceous plants, particularly potato, and the determination of their characters and quantitative variations in plant tissues. The technique is described, and the results are shown as the relative amounts of food material consumed in given periods by comparable larvae. The material to be tested was offered either as small portions of whole leaf, or as juice or extracts absorbed by pieces of elder pith.

From experiments with the juice of potato leaves extracted by pressure, it is concluded that the active principles are present in the colloidal fraction of the cellular contents. After filtration to remove the liquid part of the juice, they are found only in the non-filtrable material, coloured green by the chlorophyll, which can be coagulated by heat ; they are not therefore soluble in water [*cf.* **22** 47]. The active principles could be extracted from the leaves by warm alcohol, and when the extract had been freed from fatty material, they became soluble in water. Some of the results of experiments to determine other properties of these principles have already been noticed [**22** 7, 47]. They are chemically stable ; at ordinary temperatures they lose about half their attractiveness in a year ; and they are destroyed in a few hours in boiling water. The relative attractiveness of solanaceous plants is not apparently due to the presence of solanin, but there is evidence to suggest that the active principles may be compounds containing nitrogen. The effect of the concentration of the active principles on the amount of material consumed by the larvae has already been noticed [**22** 715]. The order of attractiveness of alcoholic extracts of solanaceous plants other than potato was the same as in experiments with their leaves or juices. A detailed account is given of the method used for determining the attractive or repellent properties of a given plant, and the results obtained by applying these tests to various solanaceous and non-solanaceous plants.

MALENOTTI (E.). **Osservazioni ed esperienze del 1935 contro la *Cydia molesta* Busck.** [Observations and Experiments in 1935 with *C. molesta*.]—*Italia agric.* **73** no. 2 reprint 17 pp., 15 figs. Rome, February 1936. [Recd. June 1936.]

An account is given of observations in Venetia on the hibernation of the larvae of *Cydia molesta*, Busck, and on the course of infestation on peach. It was found that many of the overwintering larvae spin their cocoons on prunings, which should therefore be collected in winter and destroyed. Peaches are sometimes stored in boxes in the sides of which cavities have been hollowed to give a better grip. These are used for hibernation, not only because of the shelter provided but also because the rough surface is easily worked by the larva to obtain particles to reinforce its cocoon. In cold storage rooms the larvae have been found on the wooden ceiling, the soft wood being grooved so that the larva lies half in the groove and half enveloped in the silk cover. Observations showed that cold storage for 2 months at 1–2°C. [33·8–35·6°F.] of pears infested by immature larvae merely retarded the development of the latter without killing them.

In 1935 adults were taken in bait-traps in the first half of May and again throughout the period from mid-June to mid-October. The first larvae were seen on 14th May. There appeared to be 4 generations in 1935, and the injury done was less than in 1934 when 5 occurred.

While the first generation adults emerged in mid-June in nature, a first emergence of thousands of moths of the overwintered generation took place at that time in the cold storage rooms, indicating the extent of retardation due to the low temperature.

Experiments showed that catching the moths in bait-traps only slightly decreased the number of peach shoots infested. Bands of corrugated paper twice dipped in a mixture of 5 lb. beta-naphthol in 6 pints lubricating oil did not catch very many larvae, though those caught were killed and this measure might be of value in a severe infestation. The Braconid, *Macrocentrus delicatus*, Cress., bred from American pupae imported into Bologna in 1935 [*cf. R.A.E.*, A **23** 184], was liberated in peach orchards, but at the time of writing it was not yet possible to judge the result.

RIPPER (W.). **Ueber Verbesserungen der Rübenrüsslerbekämpfung.** [On Improvements in the Control of Beet Weevils.]—*Landeskultur* **3** no. 3 reprint 4 pp., 2 figs., 7 refs. Vienna, 1936.

Barium chloride is extensively used in Austria against *Otiorrhynchus ligustici*, L., and weevils of the genus *Cleonus*, but it is easily washed off by rain in April and May and allows the weevils to consume a considerable quantity of beet leaves before they are killed.

In view of the work of Hood and Persing on the use of oils as adhesives in lead arsenate sprays [*R.A.E.*, A **17** 515; **24** 163], the author tested sprays containing 0·4–1 per cent. lead arsenate and 0·1–0·25 per cent. fish oil or linseed oil, in comparison with a spray made of a calcium arsenate paste containing 6 per cent. lead arsenate and with barium chloride. As regards resistance to rain, lead arsenate with oil was superior to the calcium arsenate paste and very much superior to barium chloride. It caused the weevils to discontinue feeding for 10–14 days, while this effect was less with the calcium arsenate paste, and, as stated above, does not occur with barium chloride. It is advised that in districts where rains are frequent in spring the beet plants with 2–4 leaves should be treated with a spray containing either 0·8 per cent. lead arsenate and 0·2 per cent. fish-oil or linseed oil, or with one containing 1 per cent. of the calcium arsenate paste. Barium chloride should be retained for subsequent applications or, if water transport is expensive, a dust of calcium arsenate (42 per cent. As_2O_5) may be applied at the rate of about 6 lb. per acre, an equal amount of precipitated chalk being added as a diluent.

FULMEK (L.). **Ein Abwehrmittel gegen den Erdbeerstecher.** [A Repellent against *Anthonomus rubi*.]—*Landeskultur* **2** no. 11 pp. 211–213. Vienna, November 1935. [Recd. June 1936.]

Wood wool, used as a mulch for strawberries in Austria, has been found to repel *Anthonomus rubi*, Hbst., the plants thus treated being much less attacked. The wood wool was dyed black, but was odourless. It is not known if undyed material would have a similar effect.

RIPPER (W.). **Die Bekämpfung der Erdraupen.** [Cutworm Control.]—*Landeskultur* **2** no. 11 pp. 213–215, 3 figs., 9 refs. Vienna, November 1935. [Recd. June 1936.]

In addition to beet, potatoes are often attacked by *Euxoa segetum*, Schiff., *E. obelisca*, Schiff., and other cutworms in Austria. The

larvae riddle the tubers with holes and often damage 15–25 per cent. of those in a field. If a winter crop does not follow the potatoes, the larvae migrate to the nearest planted fields. Formulae recommended for poison-baits are 100 lb. bran, 5–10 lb. raw sugar molasses, 5 lb. sodium fluoride and 5 gals. water, or 100 lb. wet slices of beet, 4 lb. sodium fluoride and 20 lb. molasses. The bran bait should be scattered in small lumps to avoid rapid drying.

Friederichs (K.). **Zur Phänologie einiger Parasiten der Forleule (*Panolis flammea*).** [Contribution to the Phenology of some Parasites of the Pine Noctuid *P. flammea*.]—*Ent. Z.* **50** no. 8 pp. 89–91, 1 graph, 1 ref. Frankfurt a. M., 22nd May 1936.

Particulars are given of the seasonal occurrence in Mecklenburg of the following parasites of *Panolis flammea*, Schiff.: *Ernestia rudis*, Fall., *Banchus femoralis*, Thoms., *Aphanistes armatus*, Wesm., *Exochilum circumflexum*, L., and *Ichneumon pachymerus*, Htg., as well as of 5 other less common ones.

Speyer (W.). **Saugschäden an Birne.** [Suctorial Injury to Pear.]—*Kranke Pflanze* **13** no. 6 pp. 109–111, 1 pl. Dresden, June 1936.

The pock marking of pear leaves caused by *Eriophyes pyri*, Pgst., is described. The usual measure in Germany of spraying with 10 per cent. lime-sulphur before the buds open is only partly successful, as the mites, after hibernating behind the bud scales, seem to attack the unfolded leaflets. A 10 per cent. spray should also be applied in autumn before the leaves fall, and several applications of a 2 per cent. spray should be made in summer, due regard being paid to the sensitiveness of some varieties of pear to lime-sulphur.

Injury to pear leaves by *Stephanitis pyri*, F., occurs in the warmer parts of Germany. To control this Tingid a spray of 0·2 per cent. nicotine and 1 per cent. soft soap should be applied twice with an interval of about 3 weeks.

Hase (A.). **Ueber die Dauerwirkung des Mottenschutzes durch Eulan. V. Teil. Ueber Mottenechtheit durch das waschechte Eulan LW.** [On the lasting Effect of Eulan. Part v. On the Moth-proofing Quality produced by Eulan LW which resists Washing.]—*Anz. Schädlingsk.* **12** nos. 4–5 pp. 37–41, 54–63, 9 figs., 21 refs. Berlin, April–May 1936.

This fifth part of a report on the effect of the treatment of woollen materials with Eulan products against *Tineola biselliella*, Humm. [*cf. R.A.E.*, A **23** 9, etc.] describes in detail successful tests with Eulan LW. Materials treated with a solution containing this product at the rate of 3 per cent. of the weight of the material were proof against infestation even after 30 washings with Lux in luke-warm water, each wash being followed by rinsing and drying. The same treatment also proved effective against carpet beetles (*Anthrenus* spp.).

Frickhinger (H. W.). **Der Sieg der Kontaktgifte in der Forstschädlingsbekämpfung.** [The Victory of Contact Poisons in the Control of Forest Pests.]—*Anz. Schädlingsk.* **12** no. 4 p. 41. Berlin, April 1936.

It is stated from a report by Dr. K. Escherich that experiments in the Institute for applied Entomology, Munich, and tests in the field

have shown a new proprietary contact insecticide " Detal " to be free from the uncertainty attaching to pyrethrum preparations. Dusted on spruce at the rate of about 22 lb. per acre, it at once stopped feeding by third-instar larvae of the nun moth [*Lymantria monacha*, L.] and killed them all in 2 days. It caused some injury to the May shoots of the spruce.

Schwarz (L.). **Erhebliche Holzzerstörung durch Speckkäfer.** [Considerable Destruction of Timber by *Dermestes lardarius*.]—*Anz. Schädlingsk.* **12** no. 4 p. 46, 2 figs. Berlin, May 1936.

Following the storage in a barn near Hamburg of several tons of crabs to be ground into manure, *Dermestes lardarius*, L., occurred in extraordinary abundance and infested the roof beams and other timber to a degree threatening the safety of the building. In spruce the injury extended to a depth of about half an inch.

Heil (K. H.). **Untersuchungen über die Nahrungsaufnahme der Stabheuschrecke** (*Carausius morosus*). [Investigations on the Consumption of Food by the Stick Insect, *C. morosus*.]—*Anz. Schädlingsk.* **12** no. 5 pp. 49–52, 3 figs., 13 refs. Berlin, May 1936.

In testing the action of stomach poisons on *Carausius morosus*, F., at the Institute for Plant Diseases at Geisenheim a. Rhein, either single individuals or batches are used and the plants on which they are fed include *Coleus* and ivy. Experiments in December 1935 showed that there is no difference in the amount eaten by an individual when it is fed as a member of a batch instead of singly, or when it is given entire leaves instead of pieces. On the other hand, comparative tests with unpoisoned leaves of *Coleus* and ivy showed that with *Coleus* three times as large a leaf-surface is taken, so that if the leaves were treated with an insecticide that does not rapidly inhibit feeding, three times as much poison would be ingested. It is therefore necessary to use standard test plants for the different standard test insects or to ascertain average values for all the customary test plants.

Escherich (K.). **Zur Bionomie und Oekologie des Kieferngraurüsslers** (*Brachyderes incanus* **L.**). [A Contribution to the Bionomics and Ecology of *B. incanus*.]—*Anz. Schädlingsk.* **12** no. 5 pp. 52–54, 1 fig. Berlin, May 1936.

This is a summary of the information given in a monograph by H. J. de Fluiter & P. A. Blijdorp on the grey pine weevil, *Brachyderes incanus*, L., in Holland [*R.A.E.*, A **23** 682].

Eckstein (K.). **Ein neues Mittel zur Bekämpfung des Hausbocks.** [A new Preparation for combating *Hylotrupes bajulus*.]—*Anz. Schädlingsk.* **12** no. 5 p. 63. Berlin, May 1936.

A new proprietary liquid insecticide " Imprägnier Lasolineum H " killed larvae of *Hylotrupes bajulus*, L., in split sections of a telegraph post that were painted with it. The wood was discoloured to a depth of 0·2 inch, but the liquid penetrated into the mines packed with frass, killing the larvae at a depth of 4 inches. In other experiments, it was found to act both as a contact and a respiratory poison.

LINDEMUTH (K.). **Massenauftreten des Gartenlaubkäfers im Kreise Husum.** [An Outbreak of *Phyllopertha horticola* in the Husum District.]—*Wbl. Landesbauernsch. Schles.-Holst.*, 18 Jan. 1936, no. 3. (Abstr. in *Anz. Schädlingsk.* **12** no. 5 p. 64. Berlin, May 1936.)

In the Husum district of Schleswig-Holstein, the larvae of *Anomala* (*Phyllopertha*) *horticola*, L., have done considerable injury, especially to rye and wheat. Delayed sowing of rye is advised.

SCHULZE (K.). **Starker Queckeneulenfrass an diesjährigem, deutschem Getreide.** [Severe Attack by *Trachea basilinea* of German Cereals in 1935.]—*Z. ges. Getreidew.* no. 10, October 1935. (Abstr. in *Anz. Schädlingsk.* **12** no. 5 p. 64. Berlin, May 1936.)

Considerable injury to cereals was caused by *Trachea* (*Hadena*) *basilinea*, F., in Germany in 1935. Of 99 samples of rye 96 per cent. and of 107 samples of wheat 94·5 per cent. contained injured grains.

DE BUSSY (L. P.), VAN DER LAAN (P. A.) & DIAKONOFF (A.). **Bestrijding van Nederlandsche insecten met Derris.** [The Control of Netherlands Insects with Derris.]—*Tijdschr. PlZiekt.* **42** no. 4 pp. 77–100, 4 pls. Wageningen, April 1936. (With a Summary in English.)

The origin and characteristics of derris are described, and instructions are given for preparing a dust and a spray from derris root and a spray from pure rotenone. For the dust the finely ground root is mixed with an inert carrier such as talc or kaolin. At least 90 per cent. of the mixture must pass through a sieve of 125 meshes per linear inch, equivalent to the American 0·105 mm. sieve. The reaction of the mixture must be neutral.

Some pests, such as Aphids and spinning mites, require a spray instead of a dust, and use is made of very finely ground derris root in water with a spreader. The strength depends on the amount of rotenone, a good spray being one containing 1 part rotenone in 5,000 parts water or 10,000 for very sensitive species. It is best to use roots with a high rotenone content, such as 5 per cent. Filtration is unnecessary. As rotenone is sensitive to light, the derris powder must be stored in darkness and it is inadvisable to spray in strong sunshine. Soft soap is used as the spreader, the disadvantage of its alkaline reaction being reduced by adding it after the derris is diluted. The spray is best applied at once, but it may be kept for a few days, in which case the powder must be stirred before use. Some traces of derris powder remain on the plants, and where this is undesirable, the powder should be enclosed in a bag suspended in the water, or a pure rotenone, dissolved in acetone, should be used. One part of a solution of 1 part rotenone in 25 parts acetone is diluted with 200 parts soft water containing the spreader. The prepared spray should not be stored.

A previous paper recorded tests of derris on insects in Holland in 1934 [*R.A.E.*, A **23** 256]. The work was continued in 1935, and a list is given of the numerous species, with a key indicating in five categories the degree of their susceptibility. In each case reference is given to a note on the subject in this and the previous paper. In general derris is effective against the larvae of most Lepidoptera, sawfly larvae, ants,

Chrysomelid beetles, Anthocorid bugs, Aphids, thrips and cockroaches, but is not effective against some Lepidoptera, such as *Arctia caja*, L., Coleoptera in foods and drugs, many Diptera, and Coccids.

Schoevers (T. A. C.). **Het insecticide Derris.**—*Tijdschr. PlZiekt.* **42** no. 4 pp. 101–115, 2 pls., 25 refs. Wageningen, April 1936.

This is the text of a lecture giving an account of derris, its production and properties, and methods of applying it as an insecticide. Insects against which it has been tested in Holland are mentioned [see preceding paper].

Saalas (U.). **Ueber** *Incurvaria pectinea* **Hw. (Lep., Incurvariidae).**—*Ann. ent. fenn.* **1** no. 4 pp. 113–137; **2** no. 1 pp. 1–16, 17 figs. Helsinki, 1935, 1936.

All stages of the Tineid, *Incurvaria pectinea*, Hw., are described, and a detailed account is given of the life, leaf-mines and shelters of the larvae. In South and Central Finland the flight-period extends from mid-May to mid-June. The eggs are laid in the leaf-tissue of birch or sometimes of alder and apple. The larva mines in the leaf and then spins together pieces of the upper and lower epidermis from within to form a shelter. It cuts this shelter from the leaf and drops with it to the ground, where it drags it about, feeding on fallen leaves of birch and alder. As it grows, it makes further shelters from leaf material on the ground. It probably hibernates before pupating. An Ichneumonid, *Atrometus geniculatus*, Hlmgr., was bred from a pupa.

Saalas (U.). **Varpuluteesta,** *Stephanitis oberti* **Kol. (Hem., Tingitidae), alppiruusujen vioittajana.** [*S. oberti* as a Pest of Rhododendron.]—*Ann. ent. fenn.* **2** no. 1 pp. 34–42, 4 figs., 14 refs. Helsinki, 1936. (With a Summary in German.)

Stephanitis oberti, Kol., was observed in the summer of 1935 injuring *Rhododendron* in Finland, 20-year-old bushes of *R. catawbiense* being the most severely attacked. This Tingid had previously been recorded on other plants in Finland, but not definitely on *Rhododendron*.

Jack (R. W.). **Annual Report of the Division of Entomology for the Year ended 31st December, 1935. Agricultural.**—*Rhod. Agric. J.* **33** no. 5 pp. 329–335; also in *Bull. Minist. Agric.* [*S. Rhodesia*] no. 986 pp. 1–7. Salisbury, May 1936.

The heavy invasion of *Nomadacris septemfasciata*, Serv. (red locust) at the end of 1934 was controlled by parasites [*cf. R.A.E.*, A **23** 690] and disease, chiefly *Empusa grylli* (locust fungus). Only a limited number of swarms was present throughout 1935, in spite of infiltrations from Portuguese East Africa. There was no conspicuous pre-breeding invasion from north of the Zambesi before 31st December 1935, and no egg-laying. Individuals showed ovaries not fully developed, but some appeared to be within two weeks of oviposition. The lateness of egg-laying and the absence of disease were probably due to the abnormally low humidity. More reports than usual were received of attacks on locusts by birds, chiefly storks and hawks. Brief mention is made of the experiments [**23** 423] on the effect of poisoned hoppers on birds, no indication having been obtained of any damage to them.

As regards pests of stored products, cleanliness and early and complete disposal of crops proved completely satisfactory in controlling *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., but unsatisfactory for *Calandra oryzae*, L., owing to the different conditions of maize storage. Strict enforcement of the law concerning the removal of tobacco plants from the fields during the dry season has decreased the numbers of the tobacco white fly [*Bemisia*], the vector of leaf curl disease. Poison baits containing arsenic proved useless against *Brachytrypes membranaceus*, Drury [**16** 408], but a moistened mixture of barium fluosilicate and maize meal in the proportions by weight of 1 : 25 and 1 : 50 gave promising results when a quantity half the size of a man's thumb was placed in the mouth of the main burrow. Other serious pests of tobacco were wireworms *Trachynotus* spp. and *Psammodes* spp.) and *Phthorimaea operculella*, Zell. (leaf miner).

Icerya purchasi, Mask., was more prevalent on *Citrus* than usual. *Aulacaspis cinnamoni*, Newst. (white mango scale) spread from the Umtali to the Salisbury district. Attacks of Jassids on cotton were not severe. Investigations are proceeding on a " streak " disease which has broken out on maize and is thought not to be identical with the virus disease transmitted by Jassids of the genus *Cicadulina* in other parts of Africa [**21** 486]. Of the pests of vegetable and garden plants, *Euxoa segetum*, Schiff., was the most serious. Paris Green and maize meal (1 : 50) gave promising results in heavily infested areas cleared of crops. *Plutella maculipennis*, Curt. (diamond black moth) did serious damage to cabbages near Salisbury, and *Bagrada hilaris*, Burm., damaged vegetable crops, especially crucifers, in many districts. *Dacus ciliatus*, Lw., was recorded on marrows, and the larvae of a Melolonthid did serious damage to pineapples.

Miscellaneous insect records (mostly made in the year under review) include *Bruchus chinensis*, L., on kaffir beans (*Vigna* spp.), *B. impressithorax*, Pic, which infests the seeds of *Erythrina*, *Systate sexaptus*, Mshl., which defoliates coffee, *Notolophus* (*Orgyia*) *vetustus*, Hmps., the larvae of which defoliate geraniums, and *Akermes andersoni*, Newst., found on an orange tree in the Umtali district. The weevils, *Bronchus laticornis*, Boh., and *B. subroseus*, Motsch., were found in the seeds of *Prosopis alba*, a leguminous plant imported from S. America, and *Bruchus analis*, F., was found in *Cicer arietinum* (chick pea) imported from S. Europe.

CREIGHTON (J. T.). *Anomis erosa* **Hubn. as an Insect Pest of Cotton.**— *J. econ. Ent.* **29** no. 2 pp. 279–282. Menasha, Wis., April 1936.

Cosmophila (*Anomis*) *erosa*, Hb., which until recently had been believed to infest cotton in Florida only lightly, has been found to be numerous during detailed observations carried out there over a period of 3 years. Of several hundred pupae collected from a cotton field near Gainesville in 1931, about 50 per cent. were this species and 50 per cent. *Alabama argillacea*, Hb. The larvae consume large quantities of leaf tissue and may completely defoliate the plant during their later instars. Many other malvaceous plants are also attacked ; a list is given of those that are extensively damaged.

C. erosa is found in all stages throughout the year in southern and central Florida, but possibly hibernates in the pupal stage in the north and north west of the State. Adults emerge at night and hide on the lower surfaces of the leaves during the day. Pairing took place about

24 hours after emergence, and some adults began to oviposit 5 days after emergence and continued for 27 days. The eggs are deposited singly and preferably on the lower surfaces of the leaves. The average incubation period was 4·2 days. The larval stage, which has never been observed by the author to include more than 5 instars, lasted 13–22 days. Mature larvae draw the leaf over them and pupate within it after 1–2 days in the pre-pupal stage. The pupal stage lasted 8–15 days. Larvae, prepupae and adults only survived for short periods when exposed to low temperatures ; pupae survived longer, producing moths after 19 days at 7–9°C. [44·6–48·2°F.] but not after 20 or more.

The pupae of both *C. erosa* and *A. argillacea* are parasitised by *Syntomosphyrum esurus*, Riley, and the eggs by *Trichogramma pretiosum*, Riley. Phorid parasites of *C. erosa* taken by the author were *Megaselia scalaris*, Lw., and *Puliciphora* spp., and predators attacking the larvae and pupae were *Podisus maculiventris*, Say, *Zelus bilobus*, Say, *Dysdercus suturellus*, H.-S., *Nezara viridula*, L., and the larva of *Allograpta obliqua*, Say.

The distribution of *C. erosa* in the United States and elsewhere is discussed.

Folsom (J. W.). **Notes on little-known Cotton Insects.**—*J. econ. Ent.* **29** no. 2 pp. 282–285, 6 refs. Menasha, Wis., April 1936.

A study of the feeding habits of the less important insects found on cotton in Louisiana in 1935 showed that the collective injury caused by them was considerable, though individually they are generally overlooked. The significant findings regarding the various species are briefly discussed. Adults of *Conoderus* (*Monocrepidius*) *vespertinus*, F., the larvae of which are well known as boring into the planted seeds and roots of cotton, were found to be common on all parts of the plant, especially in July, feeding on the buds and leaves and often killing small plants with only a few leaves ; and those of the Cetoniid, *Trigonopeltastes delta*, Forst., ate holes in leaves and petioles early in September. *Pachybrachys confederatus*, Fall, ate into squares in July, causing them to fall, and another Cryptocephalid, *Bassareus brunnipes*, Ol. (*clathratus*, Melsh.), was common on young cotton from 22nd June to 12th July, killing young squares, gnawing holes in bracts and leaves and making pits for long distances in the main stems, causing them to turn brown and the plants to wither. Adults of *Colaspis brunnea*, F., which have been known to attack the bracts and leaves, also ruined numbers of squares, which were excavated and fell in 24 hours, and killed small plants by feeding on the main stems and the petioles, most of the damage being done in July. The Eumolpids, *Nodonota tristis*, Ol., and *Myochrous denticollis*, Say, destroyed young buds of cotton, and also fed on other parts of the plants above ground. The Halticid, *Systena elongata*, F., damaged the squares, bracts and leaves. It may kill small plants. The Anthicid, *Notoxus calcaratus*, Horn, fed on squares in August, causing them to fall. Of the four Curculionids observed, *Compsus auricephalus*, Say, ate the leaves of seedlings and laid eggs on 16th May on the upper side of a leaf in a sticky fluid, with the opposite side of the seed leaf folded over to conceal the cluster. *Conotrachelus erinaceus*, Lec., which is recorded for the first time on cotton, was common from the middle of June until September, occurring usually in the bud clusters, where it ate into the buds and killed them. Young squares were blasted and older ones caused

to flare, turn yellow and drop. Young plants may be killed by feeding on stems and leaves. Adults of *Conotrachelus anaglypticus*, Say [*cf. R.A.E.*, A **12** 543] the larvae of which infest cotton bolls, were found in July and August feeding on squares, making them turn yellow and fall. *Centrinaspis picumnus*, Hbst., fed in bud clusters of a small cotton plant during July and killed it.

Heliothis virescens, F., was almost as common as *H. armigera*, Hb. (*obsoleta*, F.) on cotton in 1934, but prefers squares to bolls and eats leaves more freely. The larva eats a round hole in the side of the square, excavates the contents and may proceed to another. Pupation occurs sometimes in the square, but usually on the ground where the pupa remains for 11–14 days in July and August, and up to 20 days in September. In the insectary moths emerged constantly from 19th July to 28th September. *Plusia* (*Autographa*) *brassicae*, Riley, is locally an occasional pest on cotton. It was common in 1934 in Louisiana for the first time since 1925, when it defoliated large areas of cotton, retarding the growth of the plants and destroying large numbers of squares. A few larvae of *Plusia* (*Autographa*) *oo*, Stoll, were found eating the leaves. Two adults of *Cosmophila* (*Anomis*) *flava fimbriago*, Steph., were reared from cotton squares. Other Lepidoptera, of which one or two larvae were found on cotton, were *Monogona* (*Hypsoropha*) *hormos*, Hb., *Acronicta* (*Apatela*) *longa*, Gn., *Cleora pampinaria*, Gn., *Loxostege helvialis*, Wlk., *Sparganothis sulfureana*, Clem., and *S. directana*, Wlk.

Noble (L. W.). **An underground Room for breeding Parasites.**—*J. econ. Ent.* **29** no. 2 pp. 286–288, 1 fig., 1 ref. Menasha, Wis., April 1936.

To reduce temperature fluctuations, an underground breeding room, which is described in detail, was constructed in the parasite insectary at Presidio, Texas, where temperatures of 100–110°F. in summer and 20–25°F., in winter are not infrequent. The temperature range there during a week in September was 73–81°F., as compared with 63–97°F., in the screened insectary. Refrigerating equipment subsequently installed is designed to keep the temperature even more constant and to maintain it as low as 75°F., during the hottest months. Humidity controls and heating devices similar to those described in a paper already noticed [*R.A.E.*, A **19** 487] have also been installed. An electric heater consuming slightly less than 1 watt per cubic foot of air space was found to keep the room at 78–80°F. when the outside temperatures were below 30°F.

Cockerham (K. L.) & Dean (O. T.). **Notes on Life History, Habits and Distribution of** *Heterodères laurentii* **Guér.**—*J. econ. Ent.* **29** no. 2 pp. 288–296, 10 figs. Menasha, Wis., April 1936.

The Elaterid, *Heterodères laurenti*, Guér., all stages of which are described, was first recognised as a pest in the United States when it damaged sweet potato in 1927 in Alabama, where the adults had been observed at intervals since 1912. It probably originated in South or Central America, having been originally described from Peru in 1838. In the last few years it has been taken in Florida, Mississippi, South Carolina and Georgia. Details are given of the life-history in Alabama.

The maximum number of eggs laid by one individual in the laboratory was 58, with an average of 11·5. In nature more eggs are laid under trash than in cleanly cultivated fields, turf or grassland. The first eggs have been found in May of each year during the period 1929–32, maximum oviposition occurred in June, and eggs were obtained in smaller numbers throughout the summer. Records for the 4 years show the incubation period to average 8·8–10·1 days. The larval period ranged from 278 to 336 days (average 315·6). The young larvae begin feeding immediately on hatching and normally attain most of their growth within the first 8–10 weeks. Spring and summer-hatched larvae are almost full-grown by the end of November, though they feed again extensively in spring before pupating. Pupae were found from April to August, but were most numerous in May and early June. They occur within 3–4 inches of the soil surface. The pupal period for the years of observation averaged 7·6–10·7 days. The larvae feed on soil, tubers, root crops and roots of various plants, and have caused serious damage to spring and autumn harvested white potatoes and spring-planted sprouting maize and oats. Maize planted during March and April in southern Alabama appears to be more severely injured than that planted in February or mid-May, and damage is less in maize sown thickly. Some leguminous crops, crucifers and cucumbers are less severely injured. As many as 10–11 larvae per sq. ft. to a depth of 4 ins. may be found in fields of cultivated crops. In 1930 and 1931 some fields averaged 8·5 larvae per sq. ft., whereas grass and turf land averaged less than one. In 1931 there were 25 per sq. ft. under old potato vines. Distribution of the larvae under a given crop is uneven, probably owing to some factor influencing the adults in selecting oviposition sites.

Field collections of adults have shown equal numbers of the sexes; they are only active at night. Maize is the chief source of the pollen that is their staple diet. They appear to feed on pollen that has dropped to the ground and not on the tassels themselves. It is possible that they can hibernate under rubbish, as of 81 beetles placed in an outdoor hibernating-cage in December 1931, 27 were recovered in April 1932. Although hibernated adults of both sexes lived in the laboratory until 27th June, no pairing was observed and no eggs have been obtained. A few individuals have been taken at lights, but the beetles are not directly attracted to lights at night and during the day are negatively phototropic.

The most important natural enemies are the toads, *Bufo quercicus* and *B. terrestris*. Mites have been found on the larvae, and Nematodes in them, and many larvae in the laboratory die from a bacterial disease.

MARTIN (C. H.). **Preliminary Report of Trap-log Studies on Elm Bark Beetles.**—*J. econ. Ent.* **29** no. 2 pp. 297–306, 1 fig., 2 refs. Menasha, Wis., April 1936.

Experiments with trap logs for the elm bark-beetles, *Scolytus multistriatus*, Marsh., and *Hylastes* (*Hylurgopinus*) *rufipes*, Eich., were carried out during 1935 in an extensive swamp area in New York State. In addition to reducing the numbers of beetles, these logs may be used to ascertain their presence and their abundance from year to year.

Logs 3 ft. long and 3½–8½ inches in diameter were cut at about two-week intervals from 25th April to 15th September and placed in various

positions, usually on racks of sapling elm 3 ft. from the ground to keep them out of the water and above vegetation. The largest numbers of *H. rufipes* came to early spring-cut logs (average infestation of 40·5 galleries per log for those cut on 25th April and 50 per log for those cut on 15th May), whereas the largest numbers of *S. multistriatus* came to early August-cut logs (19·9 galleries per log for those cut on 1st August). Logs in deep shade attracted the largest numbers of *H. rufipes*, whereas those more exposed to the light (but not in full sunlight) attracted most *S. multistriatus*. Vertical logs attracted only half as many *S. multistriatus* as horizontal ones. Individual logs cut at certain dates appeared to remain attractive to both species longer than those cut at other dates, a few of those cut on 28th June being freshly infested at the end of 6 weeks and one at the end of 11 weeks. Beetles began entering August-cut logs 1–6 days after cutting, but a month later very few were entering. Under proper conditions logs isolated 50–300 yds. from the racks were about as attractive to *H. rufipes* as groups of racked logs. Logs in clearings under lath shelters were not attractive to either species. Treating ends and cuts in the bark with paraffin wax did not increase infestation. A gradual decrease of 15 per cent. in the water content of the phloem in the logs from 12th June to 27th September did not appear to be correlated with infestation by either *H. rufipes* or *S. multistriatus*. Standing elm trees that had been completely or partly girdled 5 times from 15th May to 20th July remained uninfested. Differences in the diameter of the logs did not influence infestation by either species, and neither entered the logs suspended 20 ft. above ground, which were, however, infested by *Magdalis* sp. Under favourable conditions *Magdalis* sp. was the most numerous of all species visiting the logs. Other beetles coming to them were *Eutetrapha* (*Saperda*) *tridentata*, Ol., which at times outnumbered *H. rufipes* tenfold, and *Scolytus sulcatus*, Lec., which came in very small numbers. *H. rufipes* was about 3 times as numerous as *S. multistriatus*.

Nelson (R. H.). **Observations on the Life History of *Platynota stultana* Wlsm., on Greenhouse Rose.**—*J. econ. Ent.* **29** no. 2 pp. 306–312, 5 refs. Menasha, Wis., April 1936.

The methods and results of life-history studies of the Tortricid, *Platynota stultana*, Wlsm., a native of Mexico and California recently found attacking greenhouse roses in Virginia [*cf. R.A.E.*, A **22** 108], are described, and a list of its food-plants in Mexico and California is given, with notes on the appearance of the various stages. The observations were made at a temperature of 70–75°F., and a relative humidity of 70–80 per cent. (the conditions of commercial rose houses) and the larvae were fed on rose. Oviposition records were obtained from fertilised females, which laid their eggs readily on glass slides in wire screen cages. Females that had not paired died without ovipositing, or laid abnormally shaped eggs that did not hatch. It is therefore concluded that *P. stultana* does not reproduce parthenogenetically. The largest number of eggs laid in one day by one moth was 188. Of 3,523 eggs deposited by 12 fertilised females, 50·86 per cent. were deposited during the first 4 days of adult life and 92·68 per cent. in the first 8 days. One female oviposited as late as the 13th day.

The egg, larval and pupal stages averaged 9, 13·1 and 9 days respectively; the larvae fed chiefly on leaf-rollers and pupated in the rolled leaves. Three species of Hymenopterous parasites, *Meteorus dimidiatus*, Cress., *Angitia ferrugineipes*, Ashm., and *Cremastus* sp., were reared from larvae collected on greenhouse roses.

THOMAS (C. A.). **Status of the Tomato Pin Worm** *Gnorimoschema lycopersicella* **Busck in Pennsylvania.**—*J. econ. Ent.* **29** no. 2 pp. 313–317. Menasha, Wis., April 1936.

A local infestation of tomato by *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, in Pennsylvania, was apparently eradicated in 1932 by omitting the autumn tomato crop and leaving the greenhouse open and unheated [*cf. R.A.E.*, A **20** 298; **21** 240], but it was observed on tomato in another locality in the State in September 1933, and a survey during 1935 showed it to be scattered in greenhouses over a very considerable area in the south-east and south, into northern Delaware. An apparently unrelated infestation had been found in 1931 in the extreme west of the State.

Details are given of the injury caused in the south-eastern area to tomato, egg-plant, potato and horse nettle [*Solanum carolinense*]. Slight feeding occurred on small tobacco leaves when no other food was available, but dry tobacco leaves were somewhat toxic. Attempts to make the larvae feed on leaves of chrysanthemum, *Calendula* or sweet pea [*Lathyrus*] were practically unsuccessful. The eggs were mostly laid on the lower surfaces of the leaves, but occasionally on the stems and fruit. The egg stage lasted 4–7 days in the laboratory. The newly hatched larva crawls some distance and makes several holes in the leaf before mining between the upper and lower surfaces. When almost half-grown, it leaves the mine and spins a web on the leaf surface, drawing together a fold in the leaf. Here it makes a larger mine, frequently destroying the leaf. When full-grown, it usually drops to the ground by a thread or makes its way down the stem and pupates in a flimsy cocoon under rubbish just beneath the soil surface, but pupae are sometimes found behind strings holding tomato plants, or, rarely, in the leaves or fruit. In the laboratory the pupal stage averaged 1½–2 weeks and the entire life-cycle 5–6 weeks. Moths pair soon after emerging. They fly at sunset and are attracted to electric lights. Much injury in lightly infested houses was near white posts to which moths were attracted. Parasites reared from the larvae were *Angitia ferrugineipes*, Ashm. (*A. blackburni*, Cam., having been recorded as parasitising 50 per cent. of the larvae in Hawaii [**16** 634]), *Microbracon juncicola*, Ashm., *Apanteles epinotiae*, Vier., and *Tetrastichus* sp., the last-named probably being secondary.

Owing to the apparent difficulty experienced by *P. lycopersicella* in passing the winter out of doors and its refusal to feed on common greenhouse plants, the best method of control is to substitute flower crops for the autumn crop of tomatos, but unless this is done uniformly, the greenhouses will become reinfested in the spring from those of any grower producing an autumn crop. Hand-picking of infested leaves at short intervals will keep down the numbers of larvae, and the practice of removing the lower leaves of plants grown in the field should serve the same purpose if they are immediately destroyed. Infested plants out of doors should be burned where they grow and ploughed under. In an infested greenhouse left closed for a week in June, when the soil

temperature rose to 109°F. 2 inches deep in the beds, 120° on the surface and 137° 5 ft. above the beds, the heat brought large numbers of moths out of the beds and killed them, larvae on the plants also being killed. Heavy cyanide fumigation at the end of the week made control more complete. In other houses sterilisation by steam was successfully used. Thorough cleaning, soil sterilisation and fumigation may not, however, effect complete eradication. There is some indication that the moth, although tropical or subtropical in origin, may become acclimatised to the winters in Pennsylvania, so that the omission of the autumn tomato crop may not always prevent reinfestation in spring. Other control measures successfully applied are dipping the young tomato plants in suspensions of calcium arsenate or lead arsenate or in phenothiazene [thiodiphenylamine] (1 lb. to 50 U.S. gals. water). Experiments showed that the larvae are easily killed by dusts or sprays of derris, pyrethrum, cubé [*Lonchocarpus*] or nicotine. Tomato leaves covered with a derris dust containing 4 per cent. rotenone remained toxic to the larvae at the end of 4 weeks. Pyrethrum and derris can be applied to seedlings at the time of setting them in the house or can be substituted for arsenicals after the tomatos form. Pyrethrum dusts also kill some of the moths. Nicotine-penetrol sprays killed larvae with which they came in contact, but penetrated few of the mines. Calcium cyanide fumigations killed many moths, but others had time to emerge and oviposit between weekly fumigations, and eggs and larvae within the mines were not killed at dosages that were not toxic to plants. Nicotine fumigations gave similar results. Larvae crawling on tomato plants were killed by naphthalene crystals placed in the same container in the laboratory. Naphthalene could be used in tomato houses if discontinued when the fruits form so that they do not absorb the odour. Tobacco dust or stems on the beds would kill larvae dropping to the ground to pupate, but might possibly carry mosaic.

Filmer (R. S.). **Spray and Dust Poisoning of Honeybees in New Jersey.**—*J. econ. Ent.* **29** no. 2 pp. 322–324. Menasha, Wis., April 1936.

The following is partly taken from the author's summary: The increase in arsenical poisoning of honeybees in New Jersey in recent years is due to the increased use of arsenical dusts in the control of pests of vegetable crops, the use of sweet clover [*Melilotus*] as a permanent cover crop in orchards where heavy spraying for codling moth [*Cydia pomonella*, L.] or special sprays against the Japanese beetle [*Popillia japonica*, Newm.] are applied, and in 1935 to the early application of a petal fall spray on account of an unusually heavy infestation of apple scab and exceptionally dry weather during the summer, which resulted in the failure of the clover crop and provided ideal conditions for the retention of dusts on the plants for prolonged periods. In a severe case of poisoning where an entire apiary of 40 colonies was wiped out, the source of poisoning was a clover field adjoining a large acreage of potatoes that had been dusted with an arsenical dust after the clover came into bloom. The use of dusts for controlling vegetable pests is in itself dangerous to bees, as even when applied under ideal conditions they tend to drift on to adjoining vegetation. The application of dusts by aeroplane is also a source of danger.

Poos (F. W.). & Johnson (H. W.). **Injury to Alfalfa and Red Clover by the Potato Leafhopper.**—*J. econ. Ent.* **29** no. 2 pp. 325–331, 2 figs., 4 refs. Menasha, Wis., April 1936.

Empoasca fabae, Harr., has apparently caused more injury to lucerne and red clover in the eastern half of the United States than has hitherto been realised. Data based on experiments in Virginia during 1929, 1931, 1932 and 1933, in which it reduced the yield of lucerne by 13·9 to 27 per cent., indicate that the plants are so weakened during a season of heavy infestation that the yield of the first cutting, which is made before the leaf-hoppers become abundant, is affected in the following spring. The grade of the hay from infested lucerne is also lowered, and its ash, protein and fat contents are reduced. Experimental data are presented to show that the amount of injury caused to lucerne and red clover is directly proportional to the numbers of leafhoppers attacking the plants. In experiments with vegetatively propagated lines of red clover to test the choice for oviposition, 74·6 per cent. of the total nymphs hatched from the foreign, more glabrous, Italian lines, and 25·4 per cent. hatched from a native rough hairy Ohio line selected for vigour.

Maughan (F. B.) & MacLeod (G. F.). **Further Studies of Onion Varieties and Onion Thrips.**—*J. econ. Ent.* **29** no. 2 pp. 335–339, 2 refs. Menasha, Wis., April 1936.

Preliminary experiments in New York demonstrated definite differences in the susceptibility of onion varieties to attack and injury by *Thrips tabaci*, Lind. [*R.A.E.*, A **21** 234]. During 1932–35, counts of thrips on at least 20 onion plants 4 times each season for each of 28 varieties showed that sweet Spanish onions have been infested with significantly fewer thrips than any other variety.

In tests, in which female adults were placed in small cages attached to leaves of the growing plants, the thrips developed normally and became adults at the same time on sweet Spanish onions and on yellow globe onions, a variety susceptible to injury. Injury to the leaves was about equally severe, but the injured areas on the sweet Spanish variety sloughed off, leaving newly formed normal tissue beneath, whereas the leaves of yellow globe onions died where feeding had occurred. The habit of growth of the onion plant as shown in the angle of contact between the leaves was found to have a direct bearing on the number of thrips occurring on a given variety. Sweet Spanish onion plants showed an average of 41 thrips per plant where the leaves had been tied together when 16–18 inches high, as compared with 22 on adjacent normal plants and 208 on yellow globe onions 6 ft. away. Since injury was not noticeable even on the tied plants, however, the angle of contact of the onion leaves is not entirely responsible for the smaller amount of damage found on sweet Spanish onions. Sweet Spanish onions transplanted from the greenhouse so as to coincide in time of maturity with yellow globe onions planted as seed were less infested than the latter, though more infested than sweet Spanish plants originating from seed that matured a month later. In experiments with bunching or green onions, sweet Spanish and Japanese varieties showed no commercial damage to the foliage, whereas other common varieties were definitely injured, indicating that the factors involved in reducing thrips populations on onion varieties operate in the early, as well as in the late stages

of growth of the plants. The thrips were found to be more numerous on yellow globe than on Spanish onions, whether they were grown in a mixed planting or separately in large blocks, but no single factor can apparently be established as the sole reason for the differences in numbers of thrips found.

Maxwell (K. E.) & MacLeod (G. F.). **Experimental Studies of the Hairy Chinch Bug.**—*J. econ. Ent.* **29** no. 2 pp. 339–343, 2 figs. Menasha, Wis., April 1936.

Unusually heavy infestations of *Blissus hirtus*, Montd., occurred on Long Island during 1932–35, and it was also reported from Ohio and Pennsylvania. Other localities and States from which chinch bug infestations of turf have been recorded, either previously or in 1935, are mentioned, and the distribution of *B. hirtus* in New York State is outlined. Heavy infestations kill grass completely, leaving clover and weeds unharmed. These replace the original turf and serve as food-plants for the bugs in autumn. Damage appears first in high, dry sandy spots, lack of moisture and exposure to direct sunlight rendering grass liable to injury. Turf surrounded by gravel drives or containing a large proportion of bent grasses (*Agrostis*) suffered particularly severely. Creeping bent grass, which is widely used for lawns and putting greens, forms a mat favourable to chinch bugs when kept at lawn length, but when top dressed and kept at green length, is relatively immune from attack. Grasses commonly used for fine turf are *Lolium* sp., *Poa* sp., *Festuca* sp. and 4 species, including several varieties and strains, of *Agrostis*. One season's experiments indicate definite differences in varietal susceptibility.

Observations in 1934 and 1935 showed the occurrence of two distinct generations of *B. hirtus* on Long Island. In the laboratory it passed through 5 nymphal instars. The proportion of long-winged adults varied from 4 to 72 per cent. according to date and locality. Hatching of first brood nymphs was a week later in 1935 than in 1934, the development of both broods being correspondingly delayed in the second season, when damage from the feeding of the second brood was more severe than that from the first, though spring rains had had no perceptible effect on the abundance of the first brood. An area of destroyed grass was quickly deserted at any time, and some migration into uninfested areas occurred when the bugs reached maturity. Hibernation occurred in infested turf, if not too much damaged, and apparently in tall grass at the edges of lawns. A fungus, *Beauveria* (*Sporotrichum*) *globulifera*, found to be prevalent in the dead bodies of adults in June 1934 and to a less extent in the autumn and throughout 1935, was seldom seen in nymphs or eggs and caused no perceptible reduction of infestations.

Among numerous insecticides tested against this Lygaeid, the most effective spray that was safe to use appeared to be 2 U.S. pints nicotine sulphate and 1 lb. potassium oleate soap in 100 U.S. gals. spray. Higher kills were obtained with double the concentration of nicotine sulphate, but the spray injured the grass. The most satisfactory dry materials were rotenone dusts ($\frac{1}{2}$ and 1 per cent. commercial preparations) and tobacco dusts specified as follows: $\frac{3}{4}$ per cent. nicotine content tobacco dust, all to pass through a 60-mesh sieve, 80 per cent. through a 100-mesh sieve; and 1 per cent. nicotine content tobacco dust, all to pass through a 70–mesh sieve, 75 per cent. through a 100-mesh

sieve. Applications of dusts in 1935 were followed by sprinkling with water, which carried the material into the turf and minimised the danger of injury by washing it off the tops of the grass. The tobacco dust containing 1 per cent. nicotine gave higher kills than that containing $\frac{3}{4}$ per cent. and produced results nearly equal to that of the spray of nicotine sulphate. The 1 per cent. rotenone dust, however, was not superior to the $\frac{1}{2}$ per cent. A dust of nicotine and lime, though highly toxic, caused some injury to lawn grasses.

METZGER (F. W.) & LIPP (J. W.). **Value of Lime and Aluminium Sulfate as a Repellent Spray for Japanese Beetle.**—*J. econ. Ent.* **29** no. 2 pp. 343–347, 1 fig., 2 refs. Menasha, Wis., April 1936.

Hydrated lime has been shown to be as repellent to *Popillia japonica*, Newm., as lead arsenate, provided that a conspicuous residue is maintained on the foliage, but it is easily washed off by rain. Following extensive laboratory tests in which aluminium sulphate was found the best material to improve the adhesiveness of the lime [*R.A.E.*, A **23** 652], further field tests were conducted in New Jersey during the summer of 1935.

The following is taken from the authors' summary of the results: The foliage of two varieties of apple were protected from attack by *P. japonica* by spraying with 20 lb. hydrated lime and 3 lb. aluminium sulphate to 100 U.S. gals. water, 3 applications at 7–10 day intervals being necessary in case of very heavy infestation. Early ripening fruit cannot be protected by this spray unless careful orchard sanitation is practised and the fruit ripens uniformly. Protection is afforded to peach foliage and fruit by the use of this combination, but after 1st July it cannot be applied with safety on early ripening varieties because of objectionable residue. Injury by *P. japonica* to asparagus (to which most sprays adhere little) is materially reduced by 3 applications of 20 lb. hydrated lime, 6 lb. aluminium sulphate and $\frac{1}{2}$ lb. sodium lauryl sulphate (as a wetter) in 100 U.S. gals. water. The foliage of cultivated blueberries and rhubarb can be protected by 2–3 applications of the spray used on peach and apple.

HALLOCK (H. C.). **Notes on Biology and Control of the Asiatic Garden Beetle.**—*J. econ. Ent.* **29** no. 2 pp. 345–356, 1 fig., 4 refs. Menasha, Wis., April 1936.

Some hitherto unpublished data on the distribution and feeding habits of *Aserica* (*Autoserica*) *castanea*, Arr., which was first found in the United States 14 years ago and has been under investigation since 1927 are given, together with information on the injury caused by the larvae and adults and measures adopted for controlling them. The beetle is most abundant in the suburban areas around New York City and Philadelphia, but isolated local colonies occur throughout the eastern coastal States from Massachusetts to South Carolina. It spreads outward each year from these infested areas and is likely to become established in many parts of the United States, except where it encounters places with a low summer rainfall or unfavourable soil conditions.

One of the most noticeable signs of its increase in the area of continuous infestation during the past 2 years is the unusual concentration of the beetles round bright lights on warm nights during July

and August. This has been a serious nuisance in places of amusement. The destruction of ornamental plants has been observed each year since *A. castanea* became established, but injury to vegetables has been noticed only since 1933 [*cf. R.A.E.*, A **22** 411].

Surveys in 3 garden areas in Long Island showed that the larvae are more numerous in weedy grassland at the sides of gardens than in the gardens themselves, though heavy infestations were also found where beets, maize, carrots and tomatos had been grown. Average larval populations ranged from 100 to 411 per sq. yd.

The larval population at any point is dependent on the choice of places for oviposition by the females. Some data from field surveys and cage tests are presented to show the influence of various plants and other factors on larval abundance. Plants that shade the ground and keep the soil rather moist and cool make conditions favourable for the hiding of adults during the daytime as well as for oviposition. A list of the food-plants of the adults in order of preference as seen in these observations and including information additional to that already noticed [**21** 236] is given. Serious destruction in gardens occurs only when the temperature is 70°F. or over. At temperatures between 60 and 70°F., even though they do not fly, the beetles leave the ground and feed to a less extent near their hiding places. During the past 8 seasons, 90 per cent. of the injury to plants has occurred between 10th July and 15th August.

Males predominate in collections on plants at night and in traps, especially early in the beetle season. As the summer advances, the percentage of females in sod land and around favoured food-plants increases.

Studies in control on Long Island have shown that the turf of lawns and golf courses may be protected from injury by the larvae by treating the soil with lead arsenate [*cf.* **21** 456]. Mulching with hay will help to protect strawberry plants, and it is possible that the use of trap crops and proper selections of plants will obviate injury in vegetable gardens. In heavily infested areas it is difficult to protect preferred food-plants from attack by the adult beetles, owing to their continual influx on each warm night. In light infestations a spray of acid lead arsenate and flour [**21** 236] helps to protect the plants. Other possible control measures against the adults include the use of light-traps and poison baits.

Felt (E. P.) & Bromley (S. W.). **Oil Effects on Shade Trees.**—*J. econ. Ent.* **29** no. 2 pp. 357–360, 7 refs. Menasha, Wis., April 1936.

Comparative tests were carried out in Connecticut in the control of certain pests of shade trees with the following types of emulsifiable oils ; a widely-used commercial oil paste-form summer spray (A) ; two free-flowing oils, not as yet marketed for spray purposes, one of the aromatic series (B) and the other of the naphthenic series (C) ; and a widely used dormant oil, sulphonated and washed with caustic, also free-flowing (D). The results of tests precluded the use of C and D as general foliage sprays on account of injury, whereas A and B appeared comparable for safety. The large amount of emulsifying agent required to produce the paste-like consistency of A involved a reduction in the actual amount of oil used as compared with B, the surface tension coefficient of which was also much lower than that of A. By proportioning the concentration of the emulsion inversely to the area of

spread, the spreading property of B was equalled to that of A and spray tests showed that at normal concentrations it was as safe to use. B was therefore selected for further tests, in which it was found to be compatible with lead arsenate, Bordeaux mixture, nicotine sulphate, several colloidal and wettable sulphurs and different combinations of these with calcium caseinate and other adhesives. It was found to be incompatible with lime-sulphur, and when used with colloidal sulphur, caused slight injury to hemlock spruce [*Tsuga*]. With a commercial copper product it caused injury to *Petunia* and rose. It gave excellent spreading properties to lead arsenate, Bordeaux, and several wettable sulphurs, and acted as a very effective carrier and wetting agent for nicotine sulphate. When used at $\frac{1}{2}$ per cent. concentration with nicotine sulphate (1–800), it produced practically 100 per cent. kills of *Cinara* (*Dilachnus*) *strobi*, Fitch, on white pine [*Pinus strobus*], a grey Aphid provisionally determined as *Eulachnus rileyi*, Williams, on mugo pine [*P. mugo*], *Periphyllus lyropictus*, Kess., on maple, *Myzocallis* (*Monellia*) sp. on hazel [*Corylus*], and *Myzocallis* (*Monellia*) *caryella*, Fitch, on black walnut [*Juglans nigra*]. Very high kills of the adults of *Paratetranychus bicolor*, Banks, and considerable ovicidal effect were obtained with this combination on oak and maple, and a high percentage of exposed nymphs of the pear psylla and persimmon psylla [*Psylla pyricola*, Först., and *Trioza diospyri*, Ashm.] were killed. No appreciable kill was obtained of protected nymphs and adults of these Psyllids, nor of Coccids. No definite injury resulted on any of the trees, which included a number of conifers, deciduous shade trees, shrubs, nut trees, fruit trees and vines, to which the $\frac{1}{2}$ per cent. concentration was applied either alone or with lead arsenate, Bordeaux, nicotine sulphate, calcium caseinate, or with a combination of these.

No change in the relation of injury caused to plants by the 4 oils occurred when oils B and C, which were found to have much smaller globules than A and D, were treated to increase their size. Oils C and D, both of which were injurious, had small and large globules respectively. The only essential difference between oil B, which was safe, and oil C, which was harmful, lay in their aromatic and naphthenic origins. There is some doubt whether oils of naphthenic origin hydrolyse after sulphonation in the same way as do those of cyclic or aromatic origin. Sulphonation and the subsequent amount of hydrolysis play an important part as regards foliage injury.

Ginsburg (J. M.). **Results with Home-made Oil Emulsions for Orchard Spraying.**—*J. econ. Ent.* **29** no. 2 pp. 361–364. Menasha, Wis., April 1936.

The following is substantially the author's summary: A comparative study was made in New Jersey between commercial oil emulsions and home-made oil emulsions in spraying apple orchards. Highly refined oils were used for summer spraying, and an unrefined light lubricating oil for dormant spraying. The emulsions were prepared in the ordinary orchard power sprayers, equipped with mixers and high pressure pumps.

Both types of oil emulsion produced equally efficient control of eggs of red mite [*Paratetranychus pilosus*, C. & F.] and Aphids when applied as delayed dormant sprays in combination with cresylic acid. The home-made summer oil emulsions compared well with the commercial

products so far as both the control of codling moth [*Cydia pomonella*, L.] and foliage injury are concerned. Several formulae for preparing home made oil emulsions are suggested.

FROST (S. W.). **Soap Washes and Oil Emulsions as Summer Sprays for Peach.**—*J. econ. Ent.* **29** no. 2 pp. 364–369. Menasha, Wis., April 1936.

In experiments carried out in 2 peach orchards in Pennsylvania in 1935, when a medium grade Orthol K oil was used in all tests at the rate of 2 per cent. emulsion or 1·7 per cent. actual oil by volume, 3 U.S. gals. spray being applied to a tree at each application, injury to foliage, though considerable, was not more serious than in other parts of the orchard where no oils were used. Basic lead arsenate (4 lb. to 100 U.S. gals.) was used in one orchard. Sulphurs were added at the rate of 10 lb. koloform, 5 lb. dritomic or 10 lb. flotation, to 100 U.S. gals. diluted oil emulsion without increasing the amount of injury. In small-scale tests on peaches and in the laboratory 1½ and 2 per cent. oil emulsions, as well as certain potash soaps made with vegetable oils or fish oil, gave high toxicity of *Paratetranychus pilosus*, C. & F., and *Lecanium nigrofasciatum*, Perg. One-quarter per cent. paraffin-wax emulsion gave 99·3 per cent. kill and 0·9 per cent. summer scalecide gave 99 per cent. kill of summer eggs of *P. pilosus*, which are easier to kill than nymphs or adults.

DRIGGERS (B. F.). **Codling Moth Experiments in New Jersey in 1935.**—*J. econ. Ent.* **29** no. 2 pp. 369–378, 3 refs. Menasha, Wis., April 1936.

On the basis of the results obtained in spraying experiments against the codling moth [*Cydia pomonella*, L.] carried out in New Jersey in 1934 [*cf. R.A.E.*, A **23** 320] further tests were carried out in 1935 to test several proprietary fixed-nicotine products.

The following is taken from the author's summary and conclusions : Relative control of *C. pomonella* in the two-brooded area at Glassboro, and the effect on fruit and foliage were determined for 10 different combinations of nicotine in comparison with lead arsenate and lime and with lead arsenate and summer oil on 3 varieties of apple. Three spreaders (sulphur-ammonium soap, Aresket and milk) were also tested with tank mixture bentonite-nicotine (nicotine sulphate and bentonite sulphur or bentonite). Summer oil plus nicotine was compared with nicotine tannate in the last 2 or 3 sprays following bentonite-nicotine, both as regards control of *C. pomonella* and effect on residue at harvest. The amount of nicotine deposited and retained on the foliage by the different nicotine combinations was studied.

Based on undamaged fruit at harvest, a proprietary compound of bentonite and nicotine carrying a zinc sticker (Black leaf 155B) gave the best control, being superior to lead arsenate and lime or oil. It was superior to lead arsenate and lime but not so effective as lead arsenate and oil in preventing infestation of the fruit. Severe foliage injury appeared late in the season on 2 varieties sprayed with Black-leaf 155B. A loose, oily dust coating, characteristic of this formula, appeared to give control of *C. pomonella* superior to that obtained with tank-mixed bentonite-nicotine carrying double or triple the amount of nicotine on the foliage. Tank-mixed bentonite-nicotine compared favourably

with lead arsenate in the production of undamaged fruit at harvest ; it was superior to either lead arsenate schedule in reducing " stings," but was inferior to lead arsenate and oil in preventing infestation. The tank-mixed bentonite-nicotine had the additional advantage of producing no fruit or foliage injury. Aresket and dry skin milk were equal to sulphur-ammonium soap as a spreader for it. Nicotine sulphate and summer oil was superior to nicotine tannate as a spray to follow bentonite-nicotine both for control and residue removal. Lime added to the bentonite sulphur and nicotine sulphate in the second brood sprays aided in the removal of the residue but greatly reduced the amount of nicotine on the foliage between sprays.

Guy (H. G.), Rice (P. L.) & Stearns (L. A.). **Effect of Procedure on Performance of certain Insecticides recommended for Codling Moth Control.**—*J. econ. Ent.* **29** no. 2 pp. 378–383, 1 fig., 4 refs. Menasha, Wis., April 1936.

An account is given of the procedures used in tests carried out in 1935 for the control of the codling moth [*Cydia pomonella*, L.] on Jonathan apples in Delaware, the results of which have been briefly noticed from another source [*R.A.E.*, A **24** 476]. Observations showed that under conditions prevailing in Delaware, where close planting and strong winds continually interfere with spraying, a more accurate comparison of materials can be secured by using plots distributed about the orchard, and each consisting of one tree only. Spray drift did not affect the relative efficiency of the insecticides when tested by single-tree plot procedure, the deposit on the fruit being largely protected by foliage from adulteration from this cause. Single-tree plots, which cover a small area and provide replicates are less subject to pronounced environmental differences, but should be enlarged by one or two trees to overcome the possibility of a poor set of fruit and should be repeated a sufficient number of times to offset such a condition.

Wilbur (D. A.) & Sabryosk (C. W.). **Chloropid Populations on Pasture Grasses in Kansas (Diptera, Chloropidae).**—*J. econ. Ent.* **29** no. 2 pp. 384–389, 6 figs., 1 ref. Menasha, Wis., April 1936.

As the result of weekly collections made throughout the growing seasons of 1933 and 1934 in three different types of pasture grasses grown experimentally in Kansas, a list is given of the 53 species of Chloropids with their numerical abundance among 11,300 individuals collected and identified. About 75 per cent. of the species of Chloropids known in the State occurred in these few experimental plots. The seasonal distribution of 25 species taken on a Kentucky blue grass [*Poa pratensis*] pasture, a native prairie grass pasture and a brome and orchard grass pasture is shown in charts for 1933 and 1934 in conjunction with precipitation and temperature records. There is an apparent relation between the emergence of Chloropids and rainfalls exceeding $\frac{1}{2}$ inch as shown in the records for 1933, the emergence of the successive generation closely following rainfalls of 1·77 ins. on 21st April, 3·35 ins. on 8th July and 1·06 and 1·81 ins. on 20th and 23rd August. A similar relation exists in collections and rainfall charts for 1934, except that *Meromyza americana*, Fitch, appeared slightly in advance of the rains. In collections in 1930 from 31 plots of introduced grasses

there was little evidence of grass preference by adult Chloropids, 25 or more examples of *Oscinella minor*, Adams, and *O. frit.*, L., being taken from each of 18 plots. The only species showing indication of food-plant preference is a species of *Madiza* near *triangulata*, Beck., 123 out of 130 examples of which were taken in collections from Kentucky blue grass in 1933 and 1934. Introduced grasses were much more attractive to Chloropids than native ones.

In addition to the collected species recorded, specimens of *Anthracophaga ingrata*, Will., were reared from grasses of the genus *Muhlenbergia*, *M. racemosa* yielding most individuals. The destruction of the upper part of the central culm was brought about by larval feeding. Below the dead section of the culm the internodes were shortened and swollen, forming a gall-like structure. Above each node of this gall, a branch was given off so that the culm had a bushy appearance. *A. ingrata* was originally reared from gall-like swellings from *Muhlenbergia mexicana* in Ohio, and a few other Chloropids have been reared from galls on grasses.

NELSON (R. H.). **Cold Storage as a Control for *Gladiolus* Thrips.**—*J. econ. Ent.* **29** no. 2 pp. 389–393, 5 refs. Menasha, Wis., April 1936.

The fact that eggs of *Taeniothrips simplex*, Morison (*gladioli*, Moult & Stnw.), in *Gladiolus* corms fail to hatch after exposure to temperatures of 33°F. or less for 7 days or more [*R.A.E.*, A **21** 465] suggested the use of cold storage for controlling this thrips in the northern United States, where it overwinters only in stores. Two seasons' experiments in which artificially infested corms in paper sacks containing 50 and 100 each were placed in cold storage while there was still sufficient corm surface left untouched to provide food, showed that complete mortality of all stages of the thrips is obtained by storing at a constant temperature of 36°F. for 2 months or 40° for 3. Limited data indicate that the larvae, pupae and adults are of about equal resistance to cold; they are much more resistant than the eggs. The possibilities of adapting this method of control to various conditions of storage are discussed.

KAGY (J. F.). **Laboratory Method of comparing the Toxicity of Substances to San José Scale.**—*J. econ. Ent.* **29** no. 2 pp. 393–397, 2 refs. Menasha, Wis., April 1936.

Heterogeneity of insect populations involving differences in viability frequently lead to erroneous conclusions in tests of insecticides. As preliminary experiments with *Aspidiotus perniciosus*, Comst., in Iowa showed great heterogeneity in regard to viability, a method was devised to overcome this difficulty. Branches about ½ inch in diameter were cut from infested apple trees in lengths of 12–16 inches. On the assumption that the population on each individual branch was homogeneous, these were then cut into 5–6 sticks according to the number of materials to be tested, one stick from each branch being set aside for control and each of the remainder sprayed with one of the emulsions to be tested. Each stick was impaled on the end of a dissecting needle inserted through a hole at the base of a bell-jar [*cf. R.A.E.*, A **12** 225], and sprayed with 2·5 cc. of a specified emulsion at a pressure of 10 lb.

per sq. inch, the needle being revolved continuously to ensure complete coverage. The groups were then kept at 30°C. [86°F.] and about 70 per cent. humidity for 72 hours. As the mortality of the control scales increased rapidly after this period, it was important not to delay determinations beyond it.

Statistical analysis (by the X^2 method) showed that the probabilities of death for the untreated scale, and the percentage mortalities obtained with the different treatments differed significantly from branch to branch. If the disturbance in the results were due to a difference in viability of the scales from the different branches, mortalities due to treatment on sticks from any one branch should always appear in the same proportion. As the departures from proportionality of the actual values in relation to the expected values were only slight, it was concluded that the departures from homogeneity among the samples under the various treatments were not due to the treatment applied but entirely to the heterogeneity of the scale population between branches. This heterogeneity, therefore, did not affect the homogeneity of the results because each treatment was applied to the same homogeneous scale population on sticks from one branch. It is concluded that this method affords a means by which homogeneous results can be obtained and accurate comparisons of materials made, and shew that conclusive results can be obtained with a heterogeneous insect population provided that homogeneous groups, each of sufficient size to provide for the desired treatments, can be drawn from the population.

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